

HANDBOOK FOR
ARCHITECTS AND BUILDERS

PUBLISHED
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OF THE

Illinois Society of Architects

VOLXXXIII 1930-31

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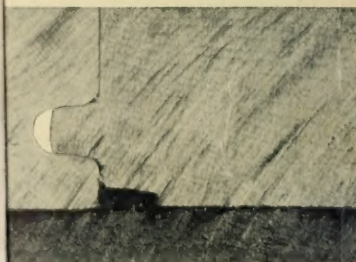
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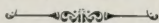
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HANDBOOK

FOR

ARCHITECTS AND BUILDERS

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THIRTY-THIRD YEAR

1930-31

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THE TRIANON,
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PREFACE

The thirty-third edition of the Handbook for Architects and Builders is again presented to the Architectural Profession. We have produced the work in its usual high standard and no time, effort or expense has been spared to give the Architect the information he requires in his daily practice.

The Handbook for Architects and Builders covers a peculiarly exclusive field and is a recognized reference work for everyone interested in Architecture. We have made but few changes from the general plan of arrangement that has proven satisfactory in former editions. Subject matter republished has been carefully revised and extended. The building ordinance has been corrected and all amendments passed within the last year have been placed in the sections affected. The special rulings of the Building Department have also been carefully checked.

The new building code, now in process of revision, is not available for publication at this time and we are advised by those in charge of the work that it may require several months more to complete the work. However, should the building ordinance be completed before the anticipated time a supplement containing same will be sent to the users of the Handbook for Architects and Builders.

The staff of our contributors remains the same with the exception of Mr. H. G. Overholt who has written on the subject of Design of Reinforced Concrete Columns under the new Building Code of the City of Chicago and Professor G. A. Maney of the Structural Engineering Department, Northwestern University, who contributes an article on Rigid Frame Analysis.

We realize, notwithstanding the care and caution which has been exercised in editing and preparing this volume, that inaccuracies may have found their way into this work and for such faults we ask our readers to forward to us their friendly criticism and constructive suggestions in order to improve succeeding editions.

The demand for the Handbook for Architects and Builders is constantly increasing and it has become almost indispensable to Architects, Engineers, Contractors, Builders, and those allied to the Building Industry.

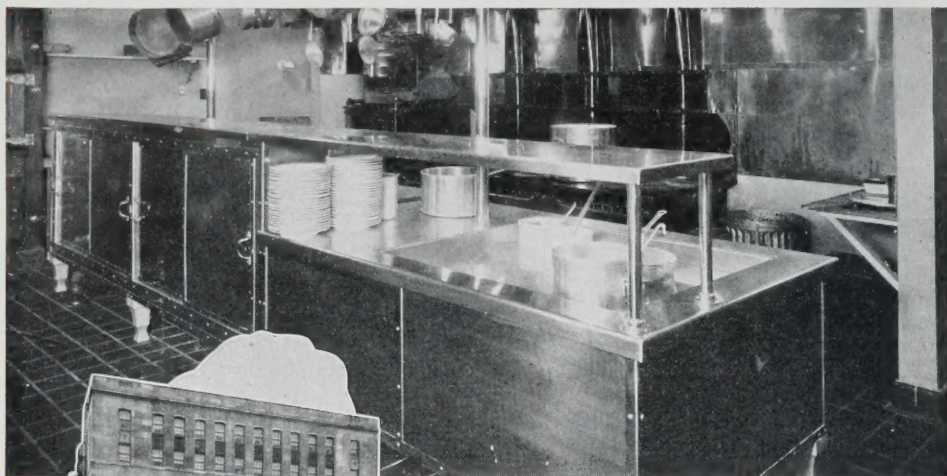
The Classified Index which appears at the end of this volume furnishes the Architect with a list of those engaged in the manufacture and sale of materials and the contracting business. We have exercised our best judgment in the selection of those represented in our advertising pages and we urge Architects, Engineers and Builders to use this list.

To the advertisers we extend our appreciation for their patronage, especially this year when business in the building industry has been abnormally low and we take pleasure in recommending these firms to the architectural profession at large.

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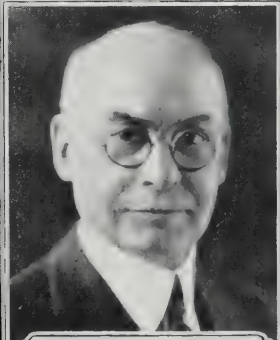
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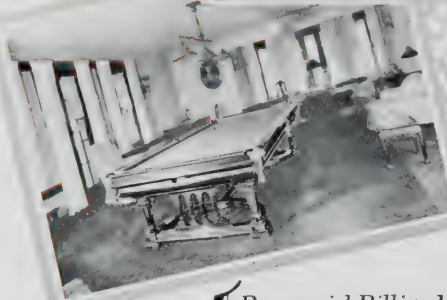
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rooms in their plans for new residences and other community buildings.

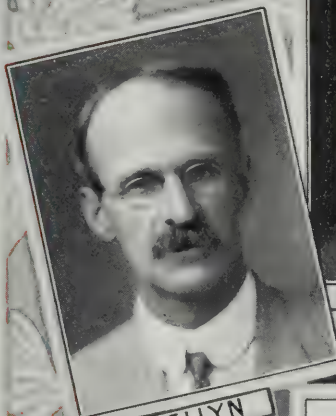
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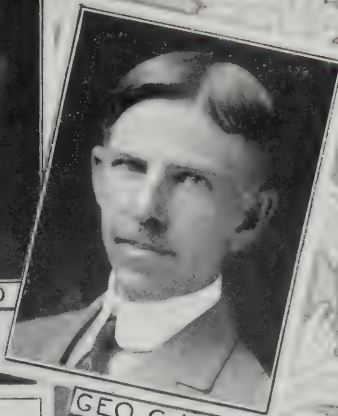
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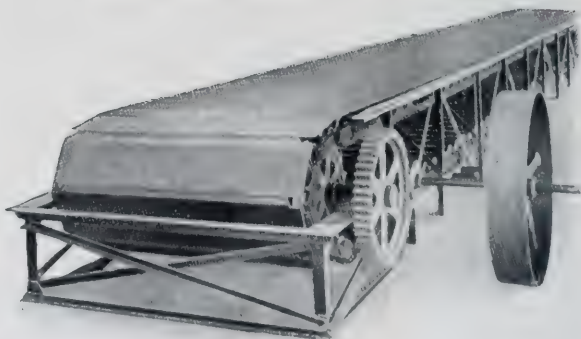
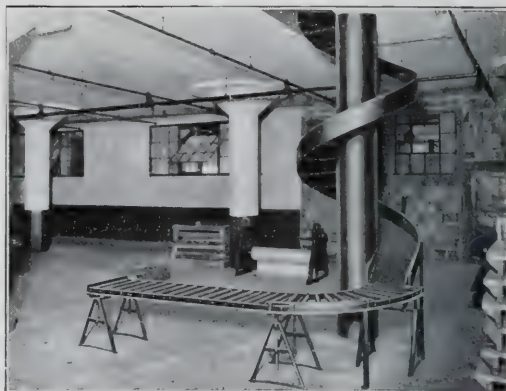
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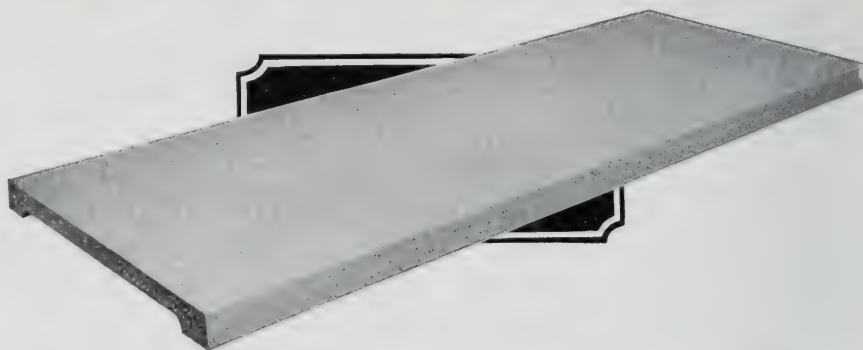
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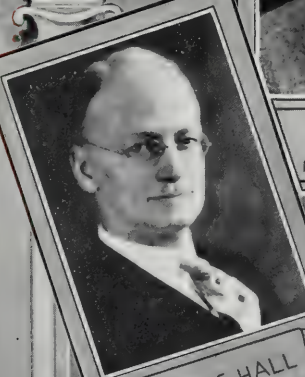


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EDITORIAL

By EMERY STANFORD HALL.

THE ARCHITECT

The architect is an artist with practical limitations. The make-believe architect may be an artist without a sense of the practical, a practical engineer without artistic concept, or a salesman with neither artistic nor practical sense. Of the three, the worst and most persistent is last named.

No man can be an artist in the design of buildings without some structural sense. It is instinctively natural for the thinkers in matters of form, proportion, and color to feel force in structure. The organized thinking essential to the solution of practical plan requirements cannot help but force a certain sense of orderliness in design. The fundamental theories of engineering are in no sense antagonistic to artistic expression in structure. If men with engineering minds could only be persuaded to listen to the spiritual side of their nature and handle their problems of expression by instinct, rather than by preconceived empirical formulae, they might be trusted to do even fine things in architecture. Preconceived notion often kills a perfectly natural artistic concept. With the salesman, the art of architecture is what he can gain thereby. Self-promotion is the controlling factor. Both the pre-eminently artistic temperament and the pre-eminently practical temperament are moved by a spirit to achieve something with a purpose outside themselves.

The architect that performs his function faithfully and well must discover the limiting conditions, perfectly meet these conditions, and clothe them in beautiful form and color.

The real architect works to meet the needs of others and has to employ others to carry out his purposes in design and practical construction. Naturally, to achieve practically satisfactory results, he must know people and how both to serve and to use them to achieve his purpose.

A just and fearless judicial spirit must dominate his acts both in his dealings with those he serves and those whose services he uses to carry out his designs. Most essential of all, however, is his judicial dealings with himself. He must be big enough to set himself up before the court of his own intellect and give himself a fair, impartial trial, then, and then only, is he fitted to command.

Many a perfect plan scheme has been lost because the discoverer of that scheme was

unable to sense its value and selected another for development. What good is inventive genius if the inventor does not know the good from the poor products of his brain.

THE RULES.

In the realm of sports, the man who does not play the game according to the rules is taboo. Games cannot be played with fairness to participants unless there are understandable, workable rules. There is no time in sports to waste on enforcing the rules. No man can be classed as a "good sport" who does not cheerfully and voluntarily obey the rules.

In the economy of the social structure there must be rules. We call them laws or ordinances, but they bear the same relationship to society as rules of a game do to sports. The good citizen obeys them voluntarily and without fear.

The "bad actor" only obeys under coercion. We would need no policemen were it not for the "bad actors" of society.

Competition is a part of the game of commerce. The architect's client, when he builds, is engaged in the game of commerce. The architect owes it both to his client and to himself to so conduct his client's business as to be in strict accord with the accepted rules of trade as well as with public laws, ordinances, and the established, honorable practice of building.

Local ordinances may not be state laws, but they are the settled rules of the local building game. If, actuated by conscience and character, one citizen obeys them and another does not, then is there "no fair" competition; therefore, no "life of trade" and building becomes a peppless game. Nobody wants to see or be in a peppless game.

To keep itself virile, architecture must insist on playing the building game according to the rules. If there are unfair or obsolete ordinances, these should be amended, not broken. If our neighbors actually build in strict accord with the same regulations as we, then does skill in plan count and the best man wins by producing the cheapest, most beautiful, enduring, and efficient house.

It is a practice contrary to all of the traditions of sportsmanship if all men in the same game are not treated exactly alike. If Jones has to put brick party walls between all of his apartments and Smith does not, Jones'



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superiorly efficient planning is offset by the excess cost of walls in his building over Smith's. Jones' client cannot sell or rent his apartments at as low a rate as Smith's client, and Jones, the better man of the two, is discredited in favor of Smith, the less efficient and less honorable of the two.

THE PUBLIC.

The public is everybody but the speaker. A person's peculiar public is primarily composed of those with whom he forms personal contacts,—social, business, or political. A man's public is the soil in which he cultivates his life's garden. It produces for him food plants, flowers, or nettles, according to the way he fertilizes, sows, cultivates, and waters it. The weeds in one's neighbor's field soon get into his field. It is much easier for all when neighbors join together to the end that each shall help the other and that all shall keep their own fields clean. Soil that has been robbed by one man is not easily restored by another. It is easier and better to constantly replenish the soil than to let it run out. Confidence and understanding are the fertilizers which produce the largest crop yield.

Architecture needs to understand this and leave no stone unturned to the end that its public shall sense its true function and worth. It is architecture's duty to assure the public that it is competently and honestly discharging its function. Public understanding demands the perfect co-operation of all of the members of the profession. Without full public appreciation and understanding the profession of architecture finds itself in a hard way. It is a way of hardness which it has built for itself through lack of whole-hearted and complete professional co-operation. There has always been a small group who, for selfish purposes, have never played the game fairly according to the rules.

THE LONE WOLF.

The Lone Wolf is separated from the pack because he cannot lead and will not follow the leader. He cannot lead because he will not play the game according to the rules. To him, rules are for the other fellow to follow. He figures that the closer he can get the other fellow to follow the rules the more profit he can make by their breaking. If he can leave out a few walls, windows, and stairs, here and there, a ventilating plant or so, he can cut the cost and take the business away from his honest competitor.

He pays no dues to professional societies, but plans to use them when he is in trouble or, perchance if he does pay dues, he does not attend the meetings except on rare occasions and only when he has a special "ax to grind."

It is through Committees that a successful society functions. The Lone Wolf Architect

never does effective service on a Committee. The men who do faithful service on Committees sacrifice much for their profession. They are "the heaven that leavens the whole lump," that is, if the lump is not too big.

Sooner or later the Lone Wolf comes to his just fate, but in the meanwhile he leaves a trail of destruction behind him that cannot be easily overcome by the faithful few who have served.

THE PRINCIPLE.

The principle of fair competition in building requires that every competitor shall be bidding on the equivalent of every other competitor for doing work to be installed under practically the same working conditions. Bidding should be a game governed by fair rules.

To insure that the competition is fair and that the meritorious bid wins, it is essential that the specifications be prepared by a technically competent disinterested third party and, also, that the bids be analyzed, equipment, good will, and technical ability of the competitors studied and rated by this same technical disinterested expert. But this is not all. The lowest bidder must sign a contract which shall insure the execution of the work as specified and shown. No such assurance is possible unless there is a provision that the maker of the plans and specifications or some other person of equivalent technical ability and independence of interest supervises the installation of the work and certifies as to its progress and the amount due the contractor under the terms of the contract. The owner is not technically qualified, and if he were, he would not be disinterested. The contractor is likely to be technically competent, but the very nature of his position makes it impossible for him to be disinterested.

The technically competent, disinterested plan, specification maker, and superintendent is by principle an essential umpire in the highly competitive game of building construction. By all the laws of reason that man should be a competent and experienced architect,—not the owner, a relative of the owner, or business partner, and not in any sense interested in contracting or building materials. Specifications prepared by competing contractors and submitted with their bids can, in no sense, be considered as a basis for fair competition.

Relative merit between architects to be fairly judged must be on a comparison of the relative merits of natural ability, educational equipment, practical experience, and integrity. The size of an architect's bank account or the magnitude of his property accumulation has no material bearing on his ability to do a certain piece of architectural work faithfully, competently, and well. Too much property acquired in the practice of

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architecture may indicate questionable practice, and it may not. In fact, without other evidence it really indicates nothing. The client is not employing an architect's bank account and the contractor who wants only a square deal is not submitting the judgment of his work to the wisdom and experience of the architect's bank account.

The architect's working money capital need not be large if his clients pay as they agree, and they ought to pay as they agree. Creative genius, integrity, and judicial painstaking care are the functions which mark the relative merit of architects. They are the kind of capital they must have in large measure. These functions can only be judged when competing architects are working under exactly the same rules. The architect who will so far forget his professional viewpoint of disinterested correct technical judgment as to cheat the city or community, or knowingly defraud a contractor in the matter of fair judgment lacks in professional understanding. It is not altogether an untrue saying that he who steals for his client will steal from his client. No man can really have two standards of honesty,—one for his client and one for the contractor and the public. The man who will connive with his client to cheat a contractor will, when opportunity offers, connive with the contractor to cheat his client. The contractor who will scheme with the owner to defraud the public by bribing a public official will rob the owner when his back is turned. The owner who will stoop to such a level will take advantage of the contractor when he gets a chance.

If a building commissioner has discretionary power in any matter, he should use it after careful public hearing, mature judgment, and without apology. If he does not have discretionary power, he should refuse to act. If the condition represents a real injustice to the owner, the law, ordinance, or rule is wrong and should be amended so as to apply to all similar cases. No owner should have an advantage over another owner because of special interpretation of the law. Rulings by departments of administration should always be universal in application to similar cases. For this reason they should be concisely worded so as to avoid misconception. Special permits passed by a City Council are unconstitutional and therefore illegal as well as unfair to the building public.

To epitomize, it is always up to the building public, owner, contractor, building commissioner, and architect to play the game according to the rules, and if the rules are wrong or obsolete they should be promptly revised,—never connived at or traded with.

To bribe a public official, to render biased judgment of a contractor's work, or to submit to coercion or bribery by the owner, contractor, or material man are dishonest practices. Dishonest practice, carelessness and recklessness in the construction of buildings, or incompetency are by law made the just cause for the revocation of an architect's registration. It behooves every architect to think carefully before he acts.

THE BRAND.

The brand is what everybody is talking about these days. The advertising fraternity has sold it to the public beyond recall. It is the aim of every industrialist to produce a brand which is known for its merit from coast to coast. Some young cubs have felt that Dad was too particular about the careful maintenance of the intrinsic merit of his particular brand of goods. And when they have come into control of Dad's plant, they have not been so particular about keeping up the merit of the brand. Coming in at a late date, they note that Dad's brand sells the goods. They cannot understand that it was Dad's goods that made Dad's brand, and that Son's goods can very quickly discredit Dad's brand.

Once discredited, a brand cannot again be restored to confidence. The reputation of a brand is even more susceptible to defamation than the reputation of a woman. Once defamed, it is almost impossible of restoration.

The name architect is a brand of merit or demerit, according to the character of competence and integrity of those entitled to use that name. It cannot be separated from the bad and applied to the good. It sinks or swims as a brand according to the general reputation of architects. If the brand architect is to be sold successfully to the public, the profession of architecture must maintain itself on a high standard of merit. Dishonest, reckless, and incompetent practitioners must be debarred from the right to use the name. The meritorious achievements of the profession must be sold to the public. Bond buyers must be made to know that buildings built without disinterested architectural design, specification, and supervision are not proper security for loans. Builders of buildings must be made to see that the design of a building and the supervision of its construction is a highly technical matter which it is unwise for a layman to undertake without the competent, disinterested guidance and assistance of an architect.



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Board of Trade, Chicago, Ill.....	Architects,	Holabird & Root, Chicago
Baltimore Trust Building, Baltimore, Md.....	Architects,	Taylor & Fisher, Baltimore
Civic Opera House, Chicago, Ill.....	Architects,	Graham, Anderson, Probst & White, Chicago
Smith-Young Tower, San Antonio, Tex.....	Architects,	Atlee B. & Robt. M. Ayres, San Antonio
Daily News Building, Chicago, Ill.....	Architects,	Holabird & Root, Chicago
Public Service Building, Portland, Ore.....	Architects,	A. E. Doyle & Assoc., Portland
Foreman-State Bank, Chicago, Ill.....	Architects,	Graham, Anderson, Probst & White, Chicago
Pacific Tel. & Tel. Bldg., San Francisco, Cal.....	Architects,	Miller & Pfeuger, San Francisco
333 No. Michigan Ave., Chicago, Ill.....	Architects,	Holabird & Root, Chicago
Gulf Office Building, Houston, Tex.....	Architect,	A. C. Finn, Houston
Pure Oil Building, Chicago, Ill.....	Architect,	F. P. Dinkelberg, Chicago
Chase National Bank, New York, N. Y.....	Architects,	Graham, Anderson, Probst & White, Chicago
Willoughby Tower, Chicago, Ill.....	Architects,	S. N. Crowen & Assoc., Chicago
Schroeder Hotel, Milwaukee, Wis.....	Architects,	Holabird & Root, Chicago
Chicago Motor Club, Chicago, Ill.....	Architects,	Holabird & Root, Chicago
Bamberger Store Building, Newark, N. J.....	Architect,	Jarvis Hunt, Chicago
Mather Tower, Chicago, Ill.....	Architect,	Herbert H. Riddle, Chicago
Bank of Manhattan, New York, N. Y.....	Architect,	H. C. Severance, New York

THE ILLINOIS SOCIETY OF ARCHITECTS

CANONS OF PROFESSIONAL ETHICS

Preamble.

The architect is engaged in a profession which carries with it grave responsibilities to the public. These duties and responsibilities cannot be met unless the motives, conduct and ability of the members of the profession are such as to command respect and confidence.

The profession of architecture calls for men of the highest integrity, and executive and artistic ability.

The architect is entrusted with financial undertakings where his honesty of purpose must be above suspicion; he acts as professional adviser to his client, and his advice must be absolutely disinterested; he is charged with the exercise of judicial functions as between client and contractor, and must act with entire impartiality, and he has moral responsibilities toward his professional associates and subordinates.

The people of the State of Illinois have a right to expect a high standard of practice and conduct on the part of the architects whom they have licensed to practice. Because an architect is a quasi public official it is imperative that he assume no obligations which shall place official duty and self-interest in conflict.

The Canons of Ethics

No set of rules can be framed which particularize all the duties of the architect in his various relations to the public, to his client, to the building trades and to his professional brethren.

The following canons of ethics cover certain broad principles which should govern the conduct of members of the profession and should serve as a guide in circumstances other than those enumerated:

I.—On Certain Duties to the Public.

The architect's more important work is of a character so permanent and enduring that he owes it to the public to use his best efforts to make it such as may raise the standard of taste in the community and be in itself a public ornament. He should design with due regard to surroundings and should endeavor to check any individualism, whether in himself or his client, that is opposed to the public good. He should take part in those movements for public betterment in which his training and experience enable him to give useful service. He should insist on safe and sanitary construction and he should at all times hold the safeguarding of human life and health as of paramount importance to the interests of client, contractor or self.

II.—On the Architect's Status.

The architect's relation to his client is primarily that of professional advisor. This relation maintains throughout the entire

period of his service. When, however, a contract is executed between his client and a builder or other person by the terms of which the architect becomes the official interpreter of its conditions and the judge of its performance, a new relation is created. In respect to the matters under contract, it is incumbent upon the architect to side neither with the client nor contractor, but to endeavor, in so far as his action may determine, that the contract be faithfully carried out according to its true spirit and intent.

It is not proper for the architect to assume to act as the owner's agent unless he has been specifically empowered so to act; by so doing he becomes a party to the contract and in a sense disqualified in his judicial capacity.

The fact that the architect's payment comes through the client does not invalidate his professional obligation to act with impartiality to both parties to the contract. It is essential, however, in order to eliminate the influence of self-interest, that the architect shall not enter into any contract with the client which shall condition his payment upon his decisions or advice.

III.—On Preliminary Drawings and Estimates.

The architect should impress upon his client at the outset the importance of sufficient time for the study and preparation of drawings and specifications. If, on the basis of approved preliminary sketches, the approximate cost of the work has been mutually considered, the architect should endeavor to bring his working drawings to meet such approximate cost, provided that his client has requested no departure from the original basis of estimate. But at the same time he should acquaint his client with the conditional character of preliminary estimates. Complete and final figures can be had only from complete and final drawings and specifications. If an unconditional limit of cost is imposed before such drawings are made and estimated, the architect must be free to make such adjustments as seem necessary to that end.

IV.—On Superintendence and Expert Service.

On all work except the simplest, it is to the interest of the client to employ an inspector or clerk-of-the-works; in many engineering problems and in certain esthetic problems such as sculpture, decorative painting, gardening and the like, it is to the interest of the client to have specialized expert service. The architect should so inform the client and assist him in obtaining such service. In order to secure unified and harmonious working organization, only such persons should be selected by the owner for consulting experts as shall work in harmony with the architect and shall be approved by him.

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V.—On the Architect's Charges.

The schedule of charges of the Illinois Society of Architects is recognized as a proper minimum of payment, but where no other architect is affected it is allowable for an architect to make such an arrangement with his client as is mutually satisfactory. He may not reduce his fee below the schedule of charges in an attempt to supplant another architect; it is reasonable and proper to charge higher rates than those of the schedule when his special skill and the quality of his service justify the increase.

A system of compensation based on the actual cost to the architect on a given piece of work plus an agreed professional fee, has much to commend it.

VI.—On Needless Expenditure.

The architect should scrupulously guard cost, and refrain from introducing needless expense or any extravagance in material or construction that may add to cost of building, without compensating gain to the client.

VII.—On Payments for Expert Service.

When retained as an expert, whether in connection with competitions or otherwise, the architect should receive a compensation proportionate to the responsibility and difficulty of the service. No duty of the architect is more exacting than such service, and the honor of the profession is involved in it. Under no circumstances should experts, knowingly, name prices in competition with each other for a given employment. Where governmental regulations prohibit adequate compensation for expert service, it is better to render such service without emolument than to accept a payment out of proportion to the importance of the service rendered.

VIII.—On the Selection of Bidders or Contractors.

The architect should advise his client in the selection of bidders and in the award of contract.

In selecting none but worthy bidders and in advising the award only to contractors who are honest and competent, the architect protects the interests of his client and helps to raise the ethical standard in building.

IX.—On Duties to the Contractor.

On the signing of a contract between owner and builder, the architect is placed in a judicial position and is bound to act with absolute fairness; he is also judge in his own right, deciding whether or not the intent of his plans or specifications is properly carried out, and exercising his judgment as to the true meaning thereof. He should, therefore, take special care to see that these drawings and specifications are complete and accurate, and he should never call upon the contractor to make good his own oversights or errors, or attempt to shirk responsibility by "blanket" clauses.

X.—On Engaging in the Building Trades.

The architect should not engage in any of the building trades, nor should he form

any trade partnership or agreement with any person or firm connected therewith: nor should he have any financial interests in any building material or device of such a nature as to render his professional action liable to a suspicion of self-interest: if he have any interest in building material or device, he should not specify or use the same without the full knowledge and approval of his client.

XI.—On Accepting Commission or Favors.

The architect may not receive any commission or any substantial service or favor from a dealer, a contractor, or from any interested person other than his client.

XII.—On Encouraging Good Workmanship.

In his authority to interpret and enforce the provisions of the contract, the architect is vested with large powers which he should use with unbiased judgment. While he must condemn bad work, he should also make a point of commending that which is good.

Intelligent initiative, artistic or mechanical, on the part of craftsmen and workmen, should be promptly recognized and encouraged, and the architect should make evident his appreciation of the dignity and importance of their work.

XIII.—On Offering Service Gratuitously.

The offering of professional service on approval, unless warranted by personal or previous business relations, tends to lower the dignity and standing of the profession: also to provide motive for dishonest representation and is to be condemned.

XIV.—On Advertising.

Advertising in any form is to be discouraged as tending to lower the standing of the profession. The presentation of ordinary business cards is a matter of individual taste and not per se improper; but the solicitation of work by circulars or advertisements and the inspiring or inserting of self-laudatory notice in the press are unprofessional.

The best recommendation of an architect is a well-merited reputation for professional capacity and fidelity to trust.

XV.—On Signing Buildings and Use of Titles.

The signing of buildings has the indorsement of the Chicago Architect's Business Association. The use of the initials designating degrees or technical society membership is proper in connection with any professional service and is encouraged as helping to make known the nature of the honor they imply.

XVI.—On Competitions.

In no way does the architect come more conspicuously before the public than through competitions. It is especially desirable that in such circumstances he should conduct himself with self-respect and dignity. To undervalue and cheapen his service or to compete where a just award is not safeguarded is inconsistent with this position. Competitions are undesirable from the stand-

Illumination



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point of both the client and the architect and a member of the Association should discourage the holding of same. If a competition becomes inevitable, because of governmental regulations, he should not enter either as a competitor or a professional advisor unless the competition is to be conducted according to the best practice and usage of the profession as formulated from time to time by the American Institute of Architects. Except as an authorized competitor he may not attempt to secure work for which competition has been instituted.

He may not present drawings to secure work for which competition has been closed but not decided.

He may not attempt to influence the award in any competition.

XVII.—On the Expert's Future Status.

An architect may not undertake a further commission on any building or work after having acted in an expert capacity in formulating a program which later is put into effect, or after having acted in an advisory capacity in the matter of awards in competition. Having acted in either or both of such capacities should bar an architect from eligibility to execute commissions upon the work in question.

XVIII.—On Criticising the Work of Others.

An architect may not criticise publicly in the press the work of a fellow architect except over his own signature, or editorially; and he may not intentionally injure, directly or indirectly, the reputation, prospects or business of a fellow architect.

XIX.—On Undertaking the Work of Another.

An architect may not undertake a commission while the just claim of a fellow architect, who had previously undertaken it, remains unsatisfied; nor may he attempt to supplant a fellow architect or to obtain a commission after steps have been taken toward the appointment of another architect.

XX.—On Duties Toward the Student Draughtsman.

It is the duty of the architect to advise and assist those who intend making architecture their career. The intending student should be urged to secure a preparation of broad general culture equivalent to that required for the degree of A. B., concurrently with or followed by a thorough course in a well organized school of architecture.

In cases where such preparation is out of the question and the beginner must get his training in the office of an architect, the latter should assist him to the best of his ability by instruction and advice. An architect, should as far as possible, urge his draughtsmen to avail themselves of educational opportunities. To this end he should give encouragement to all worthy schemes and institutions for architectural education.

Members of the society cannot too strongly insist that a thorough technical preparation for the practice of architecture should rest upon a foundation of general culture.

XXI.—On Duties Toward Building Authorities.

The architect should support all federal, state and municipal officials who have charge of matters relating to building and endeavor to maintain or improve the standards of their departments. His quasi public official capacity requires him to show respect for law by careful and conscientious compliance with all building regulations, and if any such appear to him unwise or unfair, he should endeavor to have such regulations altered, but until so altered he should comply with them. An architect because of his official relation to the state and of his moral obligation should not even under his client's instructions encourage any practices contrary to law or hostile to public interests; for he is not obliged to accept a given piece of work, hence he cannot urge in extenuation and to escape the condemnation attaching to his acts that he has but followed his client's instructions.

XXII.—On Professional Qualifications.

The assumption of the title of architect should be held to mean that the bearer has the professional knowledge, both theoretical and practical, and the natural ability needed for the proper invention, illustration and supervision of all building operations which he may undertake.

XXIII.—On Matters Adjudged Unprofessional.

The following code, based on a report of a special committee of the American Institute of Architects, is adopted by the Illinois Society of Architects as a general guide, yet the enumeration of particular duties should not be construed as the denial of the existence of others equally imperative though not specifically mentioned. It should also be noted that these sections indicate offenses of greatly varying degrees of gravity:

It is unprofessional for an architect—

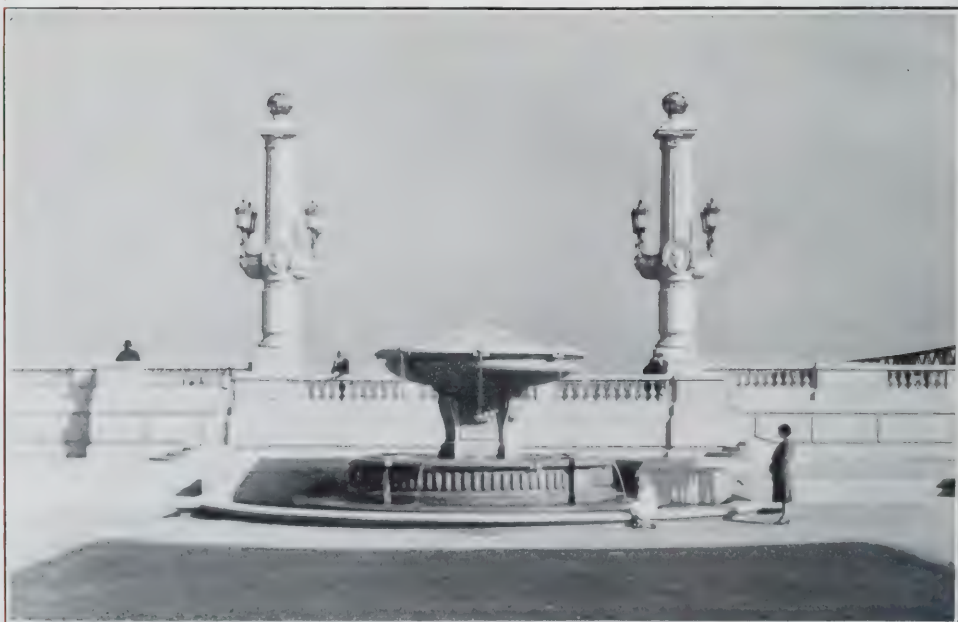
1. To engage in any of the building trades or to form any trade partnership or agreement with any person or firm engaged therein.
2. To guarantee an estimate or contract by bond or otherwise.
3. To accept a commission or any substantial service or favor from a contractor, or anyone connected with the building trades.
4. To advertise in any form.
5. To enter any competition the terms of which are not in harmony with principles approved by the American Institute, especially if such terms have been specifically condemned by the American Institute or a local chapter thereof.
6. To attempt in any way except as a duly authorized competitor to secure work for which a competition has been instituted.
7. To attempt to influence the award of a competition.
8. To injure intentionally the fair reputation, prospects or business of another architect.
9. To criticise anonymously in the public prints, except editorially, the professional conduct or work of a fellow architect.
10. To undertake a commission while the just claim of another architect who has previously undertaken it remains unsatisfied.
11. To attempt to supplant a fellow architect after definite steps have been taken toward his employment.
12. To offer or perform services at rates lower than those approved as minimum by the Illinois Society of Architects in an attempt to supplant or underbid another architect.
13. To act in a manner detrimental to the best interests of the profession.

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SCHEDULE OF PROPER MINIMUM CHARGES AND PROFESSIONAL PRACTICE OF ARCHITECTS RECOMMENDED BY THE ILLINOIS SOCIETY OF ARCHITECTS

1. The architect's professional services consist of the necessary conferences, the preparation of preliminary studies, working drawings, specifications, large scale and full size detail drawings, and of the general direction and supervision of the work, for which, except as hereinafter mentioned, the minimum charge is six per cent (6%), based upon the total cost of the work complete.

In case of the discontinuance or abandonment of the work, the architect's charge shall be based upon an *estimated* total cost, which estimated total cost may be determined by the architect, by experts, or by the lowest bids of responsible contractors. *Total cost* is to be interpreted as the cost of all materials and labor necessary to complete the work, plus contractors' profits and expenses, as such cost would be if all materials were new and all labor fully paid, at market prices current when the work was ordered.

2. On residential work, on alterations to existing buildings, on monuments, furniture, decorative and cabinet work, and landscape architecture, it is proper to make a higher charge than above indicated.

3. The architect is entitled to compensation for articles purchased under his direction, even though not designed by him.

4. If an operation is conducted under separate contracts, rather than under a general contract, it is proper to charge a special fee in addition to the charges mentioned elsewhere in this schedule.

5. Where the architect is not otherwise retained, consultation fees for professional advice are to be paid in proportion to the importance of the questions involved and services rendered.

6. Where heating, ventilating, mechanical, structural, electrical and sanitary problems are of such a nature as to require the services of a specialist, the owner is to pay for such services in addition to the architect's regular commission. Chemical and mechanical tests and surveys, when required, are to be paid for by the owner.

7. Necessary traveling expenses are to be paid by the owner.

8. If, after a definite scheme has been approved, changes in drawings, specifications or other documents are required by the owner; or if the architect be put to extra labor or expense by the delinquency or insolvency of a contractor, the architect shall be paid for such additional services and expense.

9. The architect's entire fee is itemized and proportionate payments on account are due the architect, as the following items are completed:

Preliminary Studies	2
General drawings	3
Specifications	1
Scale and full size details.....	1
General Supervision of the work.....	3

Total1.00

Fee for complete services as agreed, or see paragraphs 1 and 12.

10. Items of service are comprehended as follows:

(a) **Preliminary Studies** consist of the necessary conferences, inspections, studies and sketches modified and remodified to determine the client's problem and illustrate a satisfactory general solution of same, both as to plan and elevation. Illustrative sketches for this purpose need not be to accurate scale, but should be approximately correct as to general dimensions and proportion.

(b) **General Drawings** include figured scale plans of the various stories, elevations of all the fronts, such general vertical sections as may be necessary to elucidate the design, and such details, drawn to still larger scale as, with the assistance of printed notes, and of the accompanying specifications, may make the whole scheme clearly evident to the mind of the competent builder and give him a full and complete comprehension of all the structure conditions as they affect the vital questions of quality and quantity of materials, of character of workmanship, and of cost.

(c) **Specifications** consist of a supplementary statement in words, of at least all those items of information regarding a proposed building which are not set forth in the drawings.

(d) **Detail Drawings** include all the necessary supplementary drawings required for the use of the builders, to enable them to so provide and shape their material that it may be adjusted to its proper place or function in the building with the least delay, and the smallest chance for errors and misfits. If not prepared until after the contract for the building is let they must not impose on the contractor any labor or material which is not called for by the spirit and intent of the "General Drawings" and "Specifications."

(e) The **Supervision** of an architect (as distinguished from the continuous personal superintendence which may be secured by the employment of a clerk-of-the-works or inspector of construction) means such inspection by the architect or his deputy, of work in studios and shops or a building or other work in process of erection, completion or alteration, as he finds necessary to ascertain whether it is being executed in general conformity with his drawings and specifications or directions. He has authority to reject any part of the work which does not so conform and to order its removal and reconstruction. He has authority to act in emergencies that may arise in the course of construction, to order necessary changes, and to define the intent and meaning of the drawings and specifications. On operations where a clerk-of-the-works or inspector of construction is required, the architect shall employ such assistance at the owner's expense.

11. Drawings and specifications, as instruments of service, are the property of the architect.

12. Exceptions.	
Dwellings costing less than \$10,000.....	10%
Lofts not requiring special planning for machinery or arrangement.....	5%
Additions and alterations to dwellings..	12%
Additions and alterations to business buildings	10%

N. B.—Above schedule is considered minimum for ordinary and usual professional service. It is not considered fair or reasonable for highly specialized service.



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EXTRACTS FROM THE NEW CIVIL ADMINISTRATIVE CODE OF THE STATE OF ILLINOIS

Which Affects the practice of the Architectural Profession in this State

An Act in relation to the civil administration of the State government, and to repeal certain Acts therein named. [Approved March 7, 1917, in force July 1, 1917.]

GENERAL PROVISIONS.

Section 1. Be it enacted by the People of the State of Illinois, represented in the General Assembly: This Act shall be known as "The Civil Administrative Code of Illinois."

Sec. 2. The word "department," as used in this Act shall, unless the context otherwise clearly indicates, mean the several departments of the State government as designated in Section 3 of this Act, and none other.

Sec. 3. Departments of the State government are created as follows:

- The department of finance;
- The department of agriculture;
- The department of labor;
- The department of mines and minerals;
- The department of public works and buildings;
- The department of public welfare.
- The department of public health;
- The department of trade and commerce;
- The department of registration and education.

Sec. 4. Each department shall have an officer at its head who shall be known as a director, and who shall, subject to the provisions of this Act, execute the powers and discharge the duties vested by law in his respective department.

Sec. 5. In addition to the directors of departments, the following executive and administrative officers, boards and commissions, which said officers, boards and commissions in the respective departments, shall hold offices hereby created and designated as follows:

In the Department of Public Works and Buildings.

Assistant director of public works and buildings;

- Superintendent of highways;
- Supervising architect;
- Supervising engineer;
- Superintendent of waterways;
- Superintendent of printing;
- Superintendent of purchases and supplies;
- Superintendent of parks.

In the Department of Registration and Education.

Assistant director of registration and education.

Superintendent of registration;

The normal school board, which shall consist of nine officers, together with the director of the department and the Superintendent of Public Instruction. The above named officers, and each of them, shall, except as otherwise provided in this Act, be under the direction, supervision and control of the director of their respective departments, and shall perform such duties as such director shall prescribe. [Amended by Act approved June 24, 1921.]

Sec. 6. Advisory and non-executive boards, in the respective departments, are created as follows:

In the Department of Registration and Education.

Neither the Director, Assistant Director, Superintendent of Registration, nor any other executive and administrative officer in the Department of Registration and Education shall be affiliated with any college or school of medicine, pharmacy, dentistry, nursing, optometry, embalming, barbering, veterinary medicine and surgery, architecture, or structural engineering, either as teacher, officer or stockholder, nor shall he hold a license or certificate to exercise or practice any of the professions, trades or occupations regulated.

The Department of Registration and Education:

The director of registration and education shall receive five thousand dollars;

The assistant director of registration and education shall receive three thousand six hundred dollars;

The superintendent of registration shall receive four thousand two hundred dollars.

10. No member of an advisory and non-executive board shall receive any compensation.

11. Each executive and administrative officer, except the two food standard officers, the members of the mining board, and the members of the normal school board shall devote his entire time to the duties of his office and shall hold no other office or position of profit.

12. Each officer whose office is created by this Act shall be appointed by the Governor, by and with the advice and consent of the Senate. In any case of vacancy in such offices during the recess of the Senate, the Governor shall make a temporary appointment until the next meeting of the Senate, when he shall nominate some person to fill such office; and any person so nominated, who is confirmed by the Senate, shall hold his office during the remainder of the term until his successor shall be appointed and qualified. If the Senate is not in session at the time this Act takes effect, the Governor shall make a temporary appointment as in case of a vacancy.

14. Each officer whose office is created by this Act shall, before entering upon the duties of his office, take and subscribe the constitutional oath of office, which shall be filed in the office of the Secretary of State.

15. Each executive and administrative officer whose office is created by this Act shall, before entering upon the discharge of the duties of his office, give bond, with security to be approved by the Governor, in such penal sum as shall be fixed by the Governor, not less in any case than ten thousand dollars, conditioned for the faithful performance of his duties, which bond shall be filed in the office of the Secretary of State.

16. The director of each department is empowered to prescribe regulations, not inconsistent with law, for the government of his department, the conduct of its employees and clerks, the distribution and performance of its business and the custody, use and preservation of the records, papers, books, documents, and property pertaining thereto.

17. Each department shall maintain a central office in the capitol building at Spring-



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field, in rooms provided by the Secretary of State. The director of each department may, in his discretion and with the approval of the Governor, establish and maintain, at places other than the seat of government, branch offices for the conduct of any one or more functions of his department.

18. Each department shall be open for the transaction of public business at least from eight-thirty o'clock in the morning until five o'clock in the evening of each day except Sundays and days declared by the negotiable instrument Act to be holidays.

19. Each department shall adopt and keep an official seal.

20. Each department is empowered to employ, subject to civil service laws in force at the time the employment is made, necessary employees, and, if the rate of compensation is not otherwise fixed by law, to fix their compensation.

Sec. 25. Each director of a department shall annually on or before the first day of December, and at such other times as the Governor may require, report in writing to the Governor concerning the condition, management and financial transactions of his respective department. In addition to such reports, each director of a department shall make the semi-annual and biennial reports provided by the Constitution. The departments shall make annual and biennial reports at the time prescribed in this section, and at no other time.

26. The directors of departments shall devise a practical and working basis for co-operation and coordination of work, eliminating duplication and overlapping of functions. They shall, so far as practicable, co-operate with each other in the employment of services and the use of quarters and equipment. The director of any department may empower or require an employee of another department, subject to the consent of the superior officer of the employee, to perform any duty which he might require of his own subordinates.

27. The gross amount of money received by every department, from whatever source, belonging to or for the use of the State, shall be paid into the State treasury, without delay, not later in any event than ten days after the receipt of the same, without any deduction on account of salaries, fees, costs, charges, expenses or claim of any description whatever. No money belonging to, or for the use of, the State shall be expended or applied by any department except in consequence of an appropriation made by law and upon the warrant of the Auditor of Public Accounts.

35. The following offices, boards, commissions, arms, and agencies of the State government heretofore created by law, are hereby abolished, viz.:

State board of examiners of architects, State board of examiners of structural engineers, secretary of the State board of examiners of structural engineers, secretary-treasurer of the State board of examiners of architects, State inspector of masonry, public buildings and works, assistant State inspectors of masonry, public buildings and works, the board of administration.

The Department of Public Works and Buildings.

49. The department of public works and buildings shall have power:

1. To exercise the rights, powers and duties vested by law in the State highway department, the State highway commission, the chief State highway engineer, the assistant State highway engineer, and other officers and employees of the State highway service;

2. To exercise the rights, powers and duties vested by law in "The Canal Commissioners," their officers and employees;

3. To exercise the rights, powers and duties vested by law in the rivers and lakes commission of Illinois, its officers and employees;

4. To exercise the rights, powers and

duties vested by law in the Illinois waterway commission, its secretary, chief engineers, its other officers and employees;

5. To exercise the rights, powers and duties vested by law in the Illinois park commission, its officers and employees;

6. To exercise the rights, powers and duties vested by law in the Fort Massac trustees, their officers and employees;

7. To exercise the rights, powers and duties vested by law in the Lincoln homestead trustees, their officers and employees;

8. To exercise the rights, powers and duties vested by law in the board of commissioners of and for the Lincoln monument grounds, its officers and employees;

9. To exercise the rights, powers and duties vested by law in the superintendent of printing, his officers and employees;

10. To make contracts for and superintend the telegraph and telephone service for the several departments;

11. To purchase and supply all fuel, light, water and other like office and building services for the several departments except where the same are now supplied by the Secretary of State.

12. To procure and supply all furniture, general office equipment and general office supplies (other than stationery and office supplies distributed through the office of the Secretary of State) needed by the several departments;

13. To procure and supply all clothing, instruments and apparatus, subsistence and provisions for the charitable, penal and reformatory institutions;

14. To procure and supply all cots, beds, bedding, general room and cell equipment, table, kitchen and laundry equipment, agricultural implements, harness, stable and garage supplies, household supplies, periodicals, machinery and tools, medicines and medical supplies, plumbing, light and engine supplies, wagons and other vehicles and workshop supplies needed by the several departments;

14a. To purchase and supply all necessary tools, machinery, supplies and materials to be used by the State in or about constructing or maintaining State highways;

15. To prepare, or cause to be prepared, general plans, preliminary sketches and estimates for the public buildings to be erected for any department;

16. To have general supervision over the erection and construction of public buildings erected for any department, and over the inspection of all materials previous to their incorporation into such buildings or work;

17. To make contracts for, and supervise the construction and repair of buildings under the control of any department;

18. To prepare and suggest comprehensive plans for the development of grounds and buildings under the control of any department;

19. To make and provide all drawings, plans, specifications and models for the construction and perfection of all systems of sewerage, drainage, and plumbing for the State in connection with the buildings and grounds under the control of any department;

20. To erect, supervise and maintain all public monuments and memorials erected by the State except where the supervision and maintenance thereof is otherwise provided by law;

21. To lease, for a term not exceeding two years, storage accommodations for the several departments;

22. To lease, for a term not exceeding two years, unproductive and unused lands or other property under the control of any department, unless longer leases thereof are expressly authorized by some law enforced by the department;

23. To lease, for a term not exceeding two years, office space in buildings for the use of the several departments;

24. To have general supervision and care

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of storerooms and offices leased for the use of the departments.

50. The advisory and non-executive boards in the department of public works shall discharge the following advisory powers and functions:

The board of art advisors shall advise to the artistic character of State buildings, works and monuments, now or hereafter constructed, and to any work of a permanent character intended for decoration or commemoration;

The board of water resource advisors shall advise relative to riparian rights of the State, and the conservation, use and development of water resources;

The board of highway advisors shall advise relative to the construction, improvement and maintenance of State highways;

The board of park and buildings advisors shall advise relative to the construction, improvement and maintenance of State parks, buildings and monuments.

51. The director of public works is authorized, with the consent in writing of the Governor, to acquire, by private purchase or by condemnation under the eminent domain Act, the necessary lands for the public buildings and grounds for the departments.

52. All moneys received by the director of public works from rents, leases, sale of property or from any other source in connection with the management of the Illinois and Michigan Canal shall be covered into the State treasury, and shall be placed by the State Treasurer to the credit of a special fund to be known as the "Illinois and Michigan Canal fund."

The Department of Registration and Education.

58. The department of registration and education shall have power:

1. To exercise the rights, powers and duties vested by law in the board of education of the State of Illinois, the board of trustees of the Southern Normal University at Carbondale, the board of trustees of the Northern Illinois State Normal School at DeKalb, the board of trustees of the Eastern Illinois State Normal School at Charleston, and the board of trustees of the Western Illinois State Normal School at Macomb;

2. To exercise the rights, powers and duties vested by law in the board of veterinary examiners and the State board of live stock commissioners relating to the practice of veterinary medicine and surgery in the State of Illinois;

3. To exercise the rights, powers and duties vested by law in the board of examiners of horseshoers;

4. To exercise the rights, powers and duties vested by law in the State board of examiners of architects;

5. To exercise the rights, powers and duties vested by law in the State board of examiners of structural engineers.

60. The department of registration and education shall, wherever the several laws regulating professions, trades and occupations which are devolved upon the department for administration so require, exercise, in its name, but subject to the provisions of this Act, the following powers:

1. Conduct examinations to ascertain the qualifications and fitness of applicants to exercise the profession, trade or occupation for which an examination is held; and pass upon the qualifications of applicants for reciprocal licenses, certificates and authorities;

2. Prescribe rules and regulations for a fair and wholly impartial method of examination of candidates to exercise the respective professions, trades or occupations;

3. Prescribe rules and regulations defining, for the respective professions, trades and occupations, what shall constitute a school, college or university, or department of a university, or other institutions, reputable and in good standing and to determine the reputability and good standing of a

school, college or university, or department of a university, or other institution, reputable and in good standing by reference to a compliance with such rules and regulations;

4. Adopt rules providing for and establishing a uniform and reasonable standard of maintenance, instruction and training to be observed by all schools for nurses which are to be deemed reputable and in good standing and to determine the reputability and good standing of such schools for nurses by reference to compliance with such rules and regulations;

5. Establish a standard of preliminary education deemed requisite to admission to a school, college, or university, and to require satisfactory proof of the enforcement of such standard by schools, colleges and universities;

6. Conduct hearings on proceedings to revoke or refuse renewal of licenses, certificates or authorities of persons exercising the respective professions, trades or occupations, and to revoke or refuse to renew such licenses, certificates or authorities;

7. Formulate rules and regulations when required in any act to be administered.

None of the above enumerated functions and duties shall be exercised by the department of registration and education, except upon the action and report in writing of persons designated from time to time by the director of registration and education to take such action and to make such report, for the respective professions, trades and occupations as follows:

For the architects, five persons, one of whom shall be a member of the faculty of the University of Illinois, and the other four of whom shall be architects residing in this State, who have been engaged in the practice of architecture at least ten years;

For the structural engineers, five persons, one of whom shall be a professor in the civil engineering department of the University of Illinois, and the others of whom shall be structural engineers of recognized standing, who have had not less than ten years' practical experience, then practicing as structural engineers in this State.

The action or report in writing of a majority of the persons designated for any given trade, occupation or profession, shall be sufficient authority upon which the director of registration and education may act.

In making the designations of persons to act for the several professions, trades and occupations, the director shall give due consideration to recommendations by members of the respective professions, trades and occupations and by organizations therein.

Whenever the director is satisfied that substantial justice has not been done either in an examination or in the revocation or refusal to renew a license, certificate or authority, he may order reexaminations or re-hearings by the same or other examiners.

61. All certificates, licenses and authorities shall be issued by the department of registration and education, in the name of such department, with the seal thereof attached.

Repeal.

64. The following Acts and parts of Acts are hereby repealed:

"An Act creating the office of supervising architect of the State of Illinois and defining his powers and duties," approved April 24, 1899, in force July 1, 1899;

"An Act creating the office of supervising engineer for the General Assembly, its members and committees, and the Board of Administration of the State of Illinois, and fixing his compensation," approved June 10, 1911, in force July 1, 1911;

"An Act to create a State art commission, and to define its powers and duties," approved June 4, 1909, in force July 1, 1909;

"An Act creating the office of State inspector of masonry, public buildings and works, and prescribing qualifications, duties and compensation," approved June 28, 1915, in force July 1, 1915.

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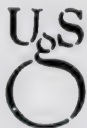


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THE ILLINOIS ARCHITECTURAL ACT

An Act to provide for the licensing of architects and to regulate the practice of architecture as a profession and to repeal certain Acts therein named.

Section 1. Be it enacted by the People of the State of Illinois, represented in the General Assembly: It shall be unlawful for any person to practice architecture or advertise or put out any sign or card or other device which might indicate to the public that he or she is entitled to practice as an architect, without a certificate of registration as a registered architect, duly issued by the Department of Registration and Education under this Act, and as provided for in the Civil Administrative Code of Illinois.

Sec. 2. Any one, or any combination of the following practices by a person shall constitute the practice of architecture, namely: The planning or supervision of the erection, enlargement or alteration of any building or buildings or of any parts thereof, to be constructed for, others. A building is any structure consisting of foundations, floors, walls, columns, girders, beams and roof, or a combination of any number of these parts, with or without other parts.

Sec. 3. No corporation shall be licensed to practice architecture in this State or be granted a certificate of registration under this Act, but it shall be lawful for a stock company or a corporation to prepare drawings, plans and specifications for buildings and structures as defined in this Act which are constructed, erected, built, or their construction supervised by such stock company or corporation, provided that the chief executive officer or managing agent of such stock company or corporation in the State of Illinois shall be a registered architect under this Act, and provided further that the supervision of such buildings and structures shall be under the personal supervision of said registered architect and that such drawings, plans and specifications shall be prepared under the personal direction and supervision of such registered architect and bear the stamp of his official seal.

It shall be lawful, however, for one or more registered architects to enter a partnership with one or more licensed structural engineers, licensed under the laws of this State, for the practice of their professions.

Sec. 4. Nothing contained in this Act shall prevent the draftsmen, students, clerks of works, superintendents and other employes of those lawfully practicing as registered architects under the provisions of this Act, from acting under the instruction, control or supervision of their employers, or to prevent the employment of superintendents of the construction, enlargement or alteration of buildings or any parts thereof, or prevent such superintendents from acting under the immediate personal supervision of the registered architect by whom the plans and specifications of any such building, enlargement

or alteration were prepared. Nor shall anything contained in this Act prevent persons, mechanics or builders from making plans, specifications for or supervising the erection, enlargement or alteration of buildings or any parts thereof to be constructed by themselves or their own employes for their own use, provided that the working drawings for such construction are signed by the authors thereof with a true statement thereon of their relation to such construction and that the makers thereof are not architects:

Provided, nothing in this Act contained shall be held or construed to have any application to any building, remodeling or repairing of any building or other structure outside of the corporate limits of any city or village, where such building or structure is to be, or is used for residential or farm purposes, or for the purposes of outbuildings or auxiliary buildings in connection with such residential or farm premises; nor shall said Act apply to any building, remodeling or repairing of any building or structure within the corporate limits of any city or village, where the total cost of said building, remodeling or repairing does not exceed the sum of seventy-five hundred dollars.

Sec. 5. Any person who is twenty-one years of age and of good moral character is qualified for an examination for a certificate of registration as a registered architect, provided he or she has graduated from a high school or secondary school, approved by the Department of Registration and Education, or has completed an equivalent course of study as determined by an examination conducted by the Department of Registration and Education, and has subsequently thereto completed such courses in mathematics, history, and language, as may be prescribed by said Department, and has had at least three years' experience in the office or offices of a reputable architect or architects.

Sec. 6. Upon payment of the required fee, an applicant who is an architect, registered or licensed under the laws of another State or territory of the United States, or of a foreign country or province, may, without examination, be granted a certificate of registration as a registered architect by the Department of Registration and Education in its discretion upon the following conditions:

(a) That the applicant is at least twenty-one years of age, of good moral character and temperate habits; and

(b) That the requirements for the registration or licensing of architects in the particular State, territory, country or province were, at the date of the license, substantially equal to the requirements then in force in this State.

Sec. 7. Every person who desires to obtain a certificate of registration shall apply therefor to the Department of Registration and Education in writing, upon blanks prepared



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and furnished by the Department of Registration and Education. Each application shall be verified by the applicant under oath and shall be accompanied by the required fee.

Sec. 8. The Department of Registration and Education shall hold examinations of applicants for certificates of registration as registered architects at such times and places as it may determine. The examination of applicants for certificates of registration as registered architects, where these applicants have had less than ten years proved architectural practice as a principal in the practice of architecture as a profession, shall consist of written and drafting tests supplemented by verbal examination at the discretion of the Examining Committee and shall embrace the following subjects:

(a) The planning, designing and construction of buildings.

(b) The strength of building materials.

(c) The principles of sanitation and ventilation as applied to buildings.

(d) The ability of the applicant to make practical application of his knowledge in the ordinary professional work of an architect and in the duties of a supervisor of mechanical work on buildings.

(e) The examinations of applicants for certificates of registration as registered architects, where the applicant shall have had ten or more years proved architectural practice as a principal in the practice of architecture as a profession, shall be by exhibits of preliminary studies, general drawings, specifications and detail drawings, prepared under the personal supervision of the applicant; by photographs of executed work and evidence of authorship, supplemented by a verbal quiz as to reasons for methods used and procedure shown and by proof of honorable practice, or by any or all of these, which in the judgment of the Examining Committee are necessary to determine the applicant's qualifications as an architect, which shall be equivalent to or superior in relative value to the requirements set forth in the preceding paragraphs of this section for an applicant having had less than ten years' experience.

The Department of Registration and Education may by rule prescribe additional subjects for examination.

Sec. 9. Whenever the provisions of this Act have been complied with by an applicant the Department of Registration and Education shall issue a certificate of registration to the applicant as a registered architect, which certificate shall have the effect of a license to the person to whom it is issued to practice architecture in this State, subject to the provisions of this Act.

Any license or certificate of registration heretofore issued under the laws of this State authorizing its holder to practice architecture shall, during the unexpired period for which it was issued, serve the same purpose as the certificate of registration provided for by this Act.

Sec. 10. Any person licensed to practice architecture in this State or registered as an architect under this Act shall be exempt from the provisions of any and all Acts in force in this State regulating the practice of structural engineering.

Sec. 11. Every holder of a certificate of registration as a registered architect shall display it in a conspicuous place in his principal office, place of business or place of employment.

Every registered architect shall have a seal, the impression of which shall contain the name of the architect and the words, "Registered Architect," "State of Illinois." He shall stamp with this seal all working drawings and specifications prepared by him or under his supervision. Any seal heretofore authorized under the laws of this State shall serve the same purpose as the seal provided for by this Act.

Sec. 12. Every registered architect who continues in active practice shall, annually, on or before the first day of July, renew his certificate of registration and pay the required renewal fee. Every license or certificate of registration which has not been renewed during the month of July in any year shall expire on the first day of August in that year. A registered architect whose certificate of registration has expired may have his certificate restored only upon payment of the required restoration fee.

Any architect registered or licensed in this State who has retired from the practice of architecture for a period of not more than five (5) years may have his certificate of registration renewed, at any time within a period of five (5) years after so retiring, upon making application to the Department for such renewal and upon payment of all lapsed annual renewal fees.

Sec. 13. The Department of Registration and Education may refuse to renew, or may suspend, or may revoke, any certificate of registration for any one or any combination of the following causes:

(a) Gross incompetency.

(b) Recklessness in the construction of buildings or their appurtenances.

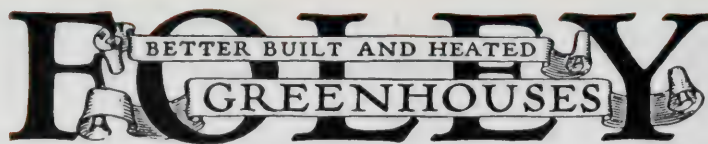
(c) Dishonest practice.

(d) When the architect has been twice convicted for a violation of any of the provisions of this Act.

(e) A person who has by false or fraudulent representation obtained or sought to obtain a certificate of registration as an architect.

The Department of Registration and Education shall not refuse to renew, nor suspend, nor shall it revoke any certificate of registration for any of the above causes until the person accused shall have been given at least twenty (20) days' notice in writing of the charge against him and a public hearing upon such charge has been had by the Department of Registration and Education.

Upon the hearing of any such proceeding, the Director of Registration and Education, the Assistant Director of Registration and



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Education, or the Superintendent of Registration may administer oaths, and the Department of Registration and Education may issue subpoenas and procure and compel the attendance of and the giving of testimony by witnesses and may compel the production of any books and papers deemed relevant to the inquiry by the Department or by the persons designated by the Department under the Civil Administrative Code of Illinois to conduct such inquiry. The accused may have the subpoena of the Department of Registration and Education for his witnesses, and may be heard in person and by counsel, in open public hearing.

Any Circuit Court, or any judge of a Circuit Court, either in term time or in vacation, upon the application either of the Department of Registration and Education or of the accused may, by order duly entered, require the attendance and enforce the giving of testimony of such witnesses and require the production of such books and papers as are above in this section referred to before the Department of Registration and Education or the persons designated by said Department under said Civil Administrative Code to conduct the inquiry, in any hearing relating to the refusal, suspension, renewal or revocation of any certificate of registration. Upon refusal or neglect to obey the order of the said court or judge, the said court or judge may compel, by attachment or proceedings for contempt of court, or otherwise, obedience to the order.

Sec. 14. The fee to be paid by an applicant for an examination to determine his fitness to receive a certificate of registration as a registered architect shall be ten dollars (\$10).

The fee to be paid by an applicant for a certificate of registration as a registered architect shall be five dollars (\$5).

The fee to be paid for the restoration of an expired certificate of registration shall be five dollars (\$5).

The fee to be paid upon renewal of a certificate of registration shall be one dollar (\$1).

The fee to be paid by an applicant for a certificate of registration who is an architect registered or licensed under the laws of another state or territory of the United States, or of a foreign country or province, shall be fifteen dollars (\$15).

Sec. 15. The Department of Registration and Education shall adopt rules and regulations in accordance with the provisions of Section 60 of said Civil Administrative Code, and not inconsistent with this Act, to carry out fully and enforce the provisions of this Act.

Sec. 16. Each of the following Acts constitutes a misdemeanor punishable upon conviction by a fine of not less than twenty-five dollars (\$25) nor more than two hundred dollars (\$200) for each offense:

(a) The practice of architecture by any person or the advertising or putting out of any sign or card or other device which might indicate to the public that he or she is entitled

to practice as an architect, without a certificate of registration as a registered architect issued by the Department of Registration and Education of this State.

(b) The making of any wilfully false oath or affirmation in any matter or proceeding where an oath or affirmation is required by this Act.

(c) The affixing of a registered architect's seal to any plans, specifications or drawings which have not been prepared by him or under his immediate personal supervision.

(d) The violation of any provision of Section 11 of this Act.

All fines and penalties shall inure to the Department of Registration and Education of this State.

Sec. 17. The Department of Registration and Education shall keep a record open to public inspection at all reasonable times of its proceedings relating to the issuance, refusal, renewal, suspension or revocation of certificates of registration. This record shall also contain the name, place of business and residence, and the date and number of registration of each registered architect in this State.

Sec. 18. The following Acts are hereby repealed: "An Act to provide for the licensing of architects and regulating the practice of architecture as a profession," approved June 3, 1897, and in force July 1, 1897, and the following Acts amendatory thereof, to-wit: An Act approved April 19, 1899, and in force July 1, 1899. An Act approved May 16, 1905, and in force July 1, 1905, and an Act approved May 26, 1911, and in force July 1, 1911.

Sec. 19. This Act may be known and cited as "The Illinois Architectural Act."

GENERAL RULES GOVERNING EXAMINATIONS.

Section 1. All communications should be addressed to the Superintendent of Registration.

Sec. 2. Lists of successful applicants only will be announced.

Sec. 3. All examinations must be written in the ENGLISH language.

Sec. 4. Application and fee must be on file at least fifteen days before date of examination. All preliminary qualifications must be verified before examination.

Sec. 5. Unmounted photo, 3x5 inches, must accompany application. A duplicate of the photo must be presented at examination, both bearing certificate as to signature and identity by the two persons who signed the letters of recommendation accompanying photo.

Sec. 6. Applicants must present cards of admission on day of examination.

Sec. 7. Examinations will begin promptly at 8:30 A. M.

Sec. 8. Grades assembled at least fifteen days after close of examination.

Sec. 9. Applicants failing in practical work must retake all subjects.

Sec. 10. Applicants failing in written work allowed credit on all grades over 75% at the following examination only.

Sec. 11. Remittances should be made by postal or express money order or bank draft
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REGISTRATION OF ARCHITECTS

STATE OF ILLINOIS

RULES AND REGULATIONS

General Statement

The Fifty-first General Assembly revised the law in relation to the regulation of the practice of architecture as a profession.

It is unlawful for any person to practice architecture or advertise or put out any sign or card or other device which might indicate to the public that he or she is entitled to practice as an architect, without a certificate of registration as a registered architect duly issued by the Department of Registration and Education. *The law provides that "no corporation shall be licensed to practice architecture."*

Any one, or any combination of the following practices constitutes the practice of architecture, namely: The planning or supervision of the erection, enlargement or alteration of any building or buildings or of any parts thereof, to be constructed for others. A building is any structure consisting of foundations, floors, walls, columns, girders, beams and roof, or a combination of any number of these parts, with or without other parts.

The professional features of the law are administered by a professional committee of architects, consisting of five persons, appointed from time to time by the Director of Registration and Education. The administrative provisions of the law are exercised by the Department of Registration and Education. The powers and duties of the professional committee are as follows:

1. To conduct examinations to ascertain the qualifications and fitness of applicants for registration, and pass upon the qualifications of applicants for reciprocal registration.
2. To prescribe rules and regulations for conducting examinations.
3. To decide the schools of architecture from which graduation will be accepted as the equivalent of two years of the prescribed office experience.
4. To conduct hearings on proceedings to revoke certificates of registration.

Applications

A person is qualified to receive a certificate of registration as a registered architect:

- (a) Who is at least twenty-one years of age.
- (b) Who has graduated from a high school or secondary school approved by the Department, or has completed an equivalent course of study as determined by an examination conducted by the Department, and has subsequently thereto completed such courses in mathematics, history and language as may be prescribed by the Department.
- (c) Who has had at least three years' experience in the office or offices of a reputable architect or architects. A certificate

of graduation from an approved school of architecture will be accepted as the equivalent of two years of the prescribed office experience; and

- (d) Who has passed an examination conducted by the Department to determine his fitness to receive a certificate of registration as a registered architect.

Examinations

Examinations of applicants for certificates of registration as registered architects are held at such times and places as the Department of Registration and Education may determine, and embrace the following subjects:

1. The planning, designing and construction of buildings.
2. The strength of building materials.
3. The principles of sanitation and ventilation as applied to buildings.
4. The ability of the applicant to make practical application of his knowledge in the ordinary professional work of an architect and in the duties of a supervisor of mechanical work on buildings.

The Department of Registration and Education may, by rule, prescribe additional subjects for examination.

All examinations are conducted in the English language without the use of an interpreter, and are divided into five sections, A, B, D, E and F.

Examination A—The Science of Planning and the Art of Designing Buildings. This examination is held the first day with a time allowance of eight hours continuous session, consisting:

First—Of a test in the science of planning, particularly with reference to practical, logical and economical arrangement; the securing of comfort and the safeguarding of life and health of the proposed occupants of the building. (Grade value 100.)

Second—Of a test in the art of designing, particularly with reference to orderly and consistent expression of purpose, logical meeting of conditions and pleasing harmonious presentation. It is not a test in a knowledge of historical styles. The grades will be based solely on the degree of perfection in meeting the before mentioned elemental requirements of good design. (Grade value 100.)

The test under "A" problem requires plans, elevations, sections and some detail drawings for a building the nature of which will be set forth in a program such as a well informed owner might be expected to give to an architect.

Time—8:30 A. M. to 4:30 P. M. en loge.

No reference books will be permitted.

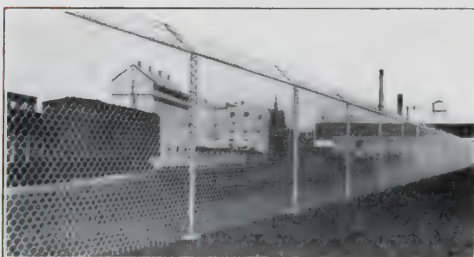
Examination B—Graphic Statics and Truss Design. This examination is held the morning of the second day with a time allowance of four hours continuous session. It consists of a test in the science of graphic



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statics as applied to a truss problem, assuming that the preliminary designs of a building are complete, loads determined and diagram of truss settled upon. The candidate is required to determine the maximum stress in each member and its section, and to detail one or more designated joints. (Grade value 100.)

Time—8:30 A. M. to 12:30 P. M.

Free use of reference books is permitted.

Examination D—Specifications, Practice and Precedent. This examination is held the afternoon of the second day with a time allowance of three and one-half hours continuous session, consisting:

First—Of a test in the knowledge of specification writing, knowledge of the essence of the contract and of general architectural practice, as it pertains to relationship between the public, the owner, the contractor and the architect. (Grade value 80.)

Second—Of a test of general knowledge of the history of architecture and its place in social economy. (Grade value 20.)

Time—1:30 P. M. to 5:00 P. M.

No reference books may be used.

Examination E—Mechanics of Materials. This examination is held the morning of the third day, with a time allowance of four hours continuous session, consisting of a test in the science of determining the strength of materials and the applicant's knowledge of applied mechanics. The test requires the applicant to design the various parts of a structure and show ability to determine the safe, practical working sizes and shapes of footings, piers, columns, beams, girders and floors. Sketches will be furnished the applicant showing conditions and loading. (Grade value 100.)

Time—8:30 A. M. to 12:30 P. M.

Free use of reference books is permitted.

Examination F—Reinforced Concrete Design. This examination is held the afternoon of the third day, with a time allowance of three and one-half hours' continuous session consisting of a test in the science of computing stresses in reinforced concrete structures and involving exercises to show the applicant's knowledge of the correct design and detailing of reinforced concrete structural parts, such as footings, columns, girders, beams and floor slabs, assuming that the preliminary designs of the building are complete, loads determined, story heights and column spacing fixed. The candidate is required to compute stresses and detail parts which are safe, practical and economical for the purposes intended. (Grade value 100.)

Time—1:30 P. M. to 5:00 P. M.

Free use of reference books is permitted.

Grading of Examination Papers

Examination papers are graded as follows: The maximum allowed on Examination A is 200; on Examinations B, D, E, and F, 100 each. The grade given the applicant on the whole examination is obtained by dividing the total A, B, D, E, and F by six.

To be successful, an applicant must make a general average of 75 with no grade in any subject below 60. If an applicant fails in his first examination, he will be permitted, upon the payment of a second examination fee, to take a second examination in those subjects in which he fell below 75 at any regular examination within eighteen months from the date of the first examination. If the applicant fails in his second examination and desires to appear for a third, it will be necessary for him to file another examination fee and be examined in ALL subjects.

Reciprocity

Upon payment of the required fee, an applicant who is an architect, registered or licensed under the laws of another state or territory of the United States, or of a foreign

country or province, may, without examination, be granted a certificate of registration as a registered architect by the Department of Registration and Education in its discretion upon the following conditions:

(a) That the applicant is at least twenty-one years of age, of good moral character and temperate habits;

(b) That the requirements for the registration or licensing of architects in the particular state, territory, country or province were, at the date the license was obtained, substantially equal to the requirements then in force in this State; and,

(c) That the applicant appears before the committee at one of its regular meetings with exhibits of his work.

(d) A regular National Council of Architectural Registration Boards investigation and report on the applicant's education and record in practice will be accepted in lieu of the requirements of the preceding paragraph "C."

Annual Renewal

Every registered architect who continues in active practice, shall annually, on or before the first day of July, renew his certificate of registration and pay the required renewal fee. Every license or certificate of registration which has not been renewed during the month of July in any year, shall expire on the first day of August in that year. A registered architect whose certificate of registration has expired may have his certificate restored only upon the payment of the required restoration fee.

Any architect registered or licensed in this State who has retired from the practice of architecture for a period of not more than five years, may have his certificate of registration renewed at any time within a period of five years after so retiring, upon making application to the Department for such renewal and upon payment of all lapsed renewal fees.

Fees

The fee to be paid by any applicant for an examination to determine his fitness to receive a certificate of registration as a registered architect is ten (\$10.00) dollars.

The fee to be paid by any applicant for a certificate of registration as a registered architect is five (\$5.00) dollars.

The fee to be paid for the restoration of an expired certificate of registration is five (\$5.00) dollars.

The fee to be paid upon renewal of a certificate of registration is one (\$1.00) dollar.

The fee to be paid by an applicant for a certificate of registration who is an architect registered or licensed under the laws of another state or territory of the United States, or of a foreign country or province, is fifteen (\$15.00) dollars.

Seal

Every registered architect shall have a seal, the impression of which shall contain the name of the architect and the words "Registered Architect, State of Illinois." He shall stamp with this seal all working drawings and specifications prepared by him or under his supervision.

Instruction to Candidates

All candidates must appear at 8:30 A. M. on the days set for the examination at the place designated on their admission cards. They must bring all necessary drawing instruments, a 24-in. T-square triangle, scales, thumb tacks, etc., for examinations A and B. For examinations D, E, and F, a filled fountain pen, pencils, scales and triangles alone will be sufficient. The use of a slide rule for mathematical calculations is permitted, but special slide rules for concrete and steel design are not to be used.

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For the first day's work, applicants must bring six sheets of medium weight tracing paper 20 by 24 inches, and one sheet of heavy detail paper 20 by 34 inches. Candidates will not be allowed to leave the room on the first day, but may bring lunch.

The paper for other examinations will be furnished by the Department.

Penalties

Each of the following acts constitutes a misdemeanor punishable upon conviction by a fine of not less than twenty-five dollars (\$25.00) nor more than two hundred dollars (\$200.00) for each offense:

(a) The practice of architecture by any person or the advertising or putting out of any sign or card or other device which might indicate to the public that he or she is entitled to practice as an architect, without a certificate of registration as a registered architect issued by the Department of Registration and Education.

(b) The making of any wilfully false oath or affirmation in any matter or proceedings where an oath or affirmation is required by this Act.

(c) The affixing of a registered architect's seal to any plans, specifications or drawings, which have not been prepared by him or under his immediate personal supervision.

(d) Neglect or failure of the holder of a certificate of registration to display it in a conspicuous place in his principal office, place of business, or place of employment.

(e) Neglect or failure of a holder of a certificate of registration to stamp with his

seal all working drawings and specifications prepared by him or under his supervision.

All fines and penalties shall inure to the Department of Registration and Education.

Suspensions—Revocations

The Department of Registration and Education may refuse to renew, or may suspend, or may revoke, any certificate of registration for any one or any combination of the following cases:

(a) Gross incompetency.

(b) Recklessness in the construction of buildings or their appurtenances.

(c) Dishonest practice.

(d) When the architect has been twice convicted for a violation of any of the provisions of this Act.

(e) A person who has by false or fraudulent representation obtained or sought to obtain a certificate of registration as an architect.

All correspondence in regard to applications, examinations, etc., should be addressed to the Department of Registration and Education, Architects Division, Springfield, Ill.

Published by order of

DEPARTMENT OF REGISTRATION AND EDUCATION:

MICHAEL F. WALSH,

Director.

P. B. JOHNSON,

Superintendent of Registration.

STATES REQUIRING ARCHITECTURAL REGISTRATION

Information as to registration laws now in force in the following states may be obtained as follows:

Arizona—State Board of Registration for Architects, Engineers, Land Surveyors, and Assayers. Mr. V. C. Wallingford, Secretary, P. O. Box 1035, Phoenix, Arizona. H. V. Kruse, Chairman; L. M. Fitzhugh, Vice-Chairman; G. M. Butler, L. B. Hitchcock, Paul E. Fernald, George T. Herrington.

California—State Board of Architecture. Southern District—A. M. Edelman, Secretary, 1124 Associated Realty Bldg., Los Angeles. William H. Wheeler, President; Myron Hunt, William J. Dodd, John Parkinson.

Northern District—Albert J. Evers, Secretary, 537 Phelan Building, San Francisco. John J. Donovan, President; James W. Plachek, James S. Dean, Frederick H. Meyer.

Colorado—State Board of Examiners of Architects, Richard O. Parry, Secretary-Treasurer, 616 C. A. Johnson Bldg., Denver, Colorado. Lester L. Jones, President; William N. Bowman, Frank W. Frewen, T. R. Wiegner.

District of Columbia—Board of Examiners and Registrars of Architects, L. M. Leisnering, 1707 Eye Street, N. W., Washington, D. C. Edward Donn, President; Frederick H. Brooke, Treasurer; Robert F. Beresford, Frank Upman.

Florida—State Board of Architecture, Mellen C. Greeley, Secretary-Treasurer, 32 West Forsyth Street, Jacksonville, Florida. Fred J. James, President; Rudolph Weaver, George L. Pfeiffer, Alvin R. Moore.

Georgia—State Board for the Examination and Registration of Architects, E. C. Wachendorff, Secretary, 1010 Standard Building, Atlanta, Georgia. Phil P. Scroggs, Acting Pres.; G. Lloyd Preacher, Arthur F. Comer, E. O. Smith.

Idaho—Department of Law Enforcement, C. A. Sundberg, Dean Ivan C. Crawford, C. W. Wayland, Fred C. Hummell.

Indiana—State Board of Registration for Architects, J. H. Owens, Secretary, Indianapolis, Indiana. L. A. Turnock, Chairman; F. S. Cannon, Vice-Chairman; Prof. W. A. Knapp, R. F. Daggett, L. W. Bruck.

Illinois—Illinois Architectural Commission, James M. White, Secretary, 256 Administration Building, West, Urbana, Illinois. E. S. Hall, Chairman; H. E. Hewitt, Prof. L. H. Provine, R. C. Ostergren.

Iowa—Board of Architectural Examiners, Mr. Oren Thomas, Secretary, 810 Hubbell Building, Des Moines, Iowa. H. D. Rawson, President; A. H. Ebeling, Vice-President; J. Chris Jensen, W. L. Perkins.

Louisiana—State Board of Architectural Examiners, Charles A. Favrot, Secretary, Hibernia Bank Building, New Orleans, Louisiana. Sam Stone, President; Allison Owen, Vice-President; J. Y. Snyder, I. C. Carter.

Michigan—State Board of Examiners for Registration of Architects, Engineers, Surveyors, C. T. Olmsted, Corresponding Secretary, 1043 Book Building, Detroit, Michigan. E. M. Walker, President; Emil Lorch, Vice-President; George Jerome, Secretary; George L. Harvey, Byron E. Parks, John J. Cox.

Minnesota—Board of Registration for Architects, Engineers, and Land Surveyors, Paul Doty, Chairman, 605 New York Building, St. Paul, Minnesota. F. W. McKellip, Vice-Chairman; William W. Tyrie, Secretary-Treasurer; Charles Foster, M. E. Chamberlin, Beaver Wade Day, F. G. German.

Mississippi—State Board of Architecture, Vinson B. Smith, Secretary-Treasurer, Gulfport, Mississippi. W. A. Stanton, President; C. H. Lindsley, R. C. Cowan, Frank P. Gates, R. C. Springer.

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Montana—State Board of Architectural Examiners, W. R. Plew, Secretary-Treasurer, State College, Bozeman, Montana. Fred F. Willson, President; George H. Shanley, Vice-President.

New Jersey—State Board of Architects, J. O. Hunt, Secretary, 219 E. Hanover St., Trenton, New Jersey; Hugh A. Kelly, President; C. V. R. Bogert, Ernest A. Arend, Howard A. Stout.

North Dakota—State Board of Architecture, Arthur Van Horn, Secretary, Bismarck, North Dakota; S. Marius Houkon, President; Theodore B. Wells, Vice-President.

New York—State Board of Examiners and Registration of Architects, Mr. William P. Bannister, Secretary, 101 Park Ave., New York City, New York; Edward B. Green, President; Albert L. Brockway, Francke H. Bosworth, Charles Butler, Harvey Wiley Corbett.

North Carolina—State Board of Architectural Examination and Registration, Harry Barton, Secretary, Greensboro, North Carolina; W. C. Northup, President; W. G. Rogers, Vice-President; W. H. Lord, Treasurer; James B. Lynch.

Oklahoma—State Board of Examiners of Architects, F. W. Redlich, Secretary-Treasurer, 1231 W. 4th St., Stillwater, Oklahoma; Leonard H. Bailey, President; R. W. Shaw, Leon B. Senter, A. Endacott.

Oregon—State Board of Architect Examiners, Margaret Goodin, Secretary, 619 Railway Exchange Bldg., Portland, Oregon; J. V. Bennes, President; Morris H. Whitehouse, Treasurer; Frank C. Clark, J. E. Wicks, Joseph Jacobberger.

Pennsylvania—State Board of Examiners of Architects, M. I. Kast, Secretary, 222 Market Street, Harrisburg, Pennsylvania; Clarence W. Brazer, President; David H. Morgan, John Hall Rankin, Charles T. Ing-ham.

South Carolina—State Board of Architectural Examiners, J. H. Sams, Secretary-Treasurer, Columbia, South Carolina; Charles C. Wilson, Chairman; Rudolph E. Lee, H. Olin Jones, Walter E. Rowe.

South Dakota—State Board of Engineering and Architectural Examiners, George C.

Hugill, Secretary, 367 Boyce-Greeley Bldg., Sioux Falls, South Dakota; Albert McWayne, Chairman Charles A. Trimmer, R. R. Pullen, J. O. Kammerman.

Tennessee—State Board of Architectural and Engineering Examiners, J. W. Holman, Secretary, 702 Stahlman Building, Nashville, Tennessee (Arch.); Bayard S. Cairns, (Arch.), W. H. Sears (Arch.), N. W. Dougherty (Engr.), Chairman; Thomas H. Allen (Engr.), H. H. Bailey (Engr.).

Utah—Department of Registration and Education, S. W. Golding, Director, Salt Lake City, Utah; W. E. Ware, Utah Savings and Trust Bldg., Salt Lake City, Utah; Leslie S. Hodson, Ogden, Utah; Claude S. Ashworth, Provo, Utah.

Virginia—State Board for the Examination and Certification of Prof. Engineers, Architects and Land Surveyors, C. G. Massie, Secretary, Lynchburg, Va.; Fred E. Ruediger, President; Edmund S. Campbell, Vice-President; W. D. Tyler, James M. MacTier, Charles M. Robinson, S. S. Johnson, Elmer E. Barnard, R. D. Budd.

Washington—Department of Licenses, Chas. R. Maybury, Director, Olympia, Washington; George Gove, Puget Sound Bank Bldg., Tacoma, Washington; Harry H. James, 514 Alaska Bldg., Seattle, Washington; Julius A. Zittel, Auditorium Bldg., Spokane, Wash.

West Virginia—State Board of Examiners and Registration of Architects, A. F. Wysong, Secretary, Charleston, West Virginia; Theodore Sansbury, President; Charles L. Hickman, M. F. Giesey, Martin J. Garry.

Wisconsin—Board of Examiners of Architects, Arthur Peabody, Secretary, Madison, Wis.; Henry A. Foeller, Alex. C. Eschweiler, Fitzhugh Scott, F. E. Turneaure.

Hawaii—Territorial Board of Registration, William C. Furer, 506 Hawaiian Trust Bldg., Honolulu.

Philippines—Board of Examiners for Architects, Cheri Mandelbaum, Secretary, Division of Public Works, Bureau of Architecture, Manila.

Porto Rico—Insular Board of Examiners of Engineers, Architects and Surveyors, Antonio S. Romero, Intendencia Building, San Juan.

NATIONAL COUNCIL OF ARCHITECTURAL REGISTRATION BOARDS

Explaining the Function, Scope, Service and Method of Operation of the National Council of Architectural Registration Boards Circular of Advice Number 4.

Introductory Statement.

1. Briefly stated, the Council constitutes a clearing house for the convenience of the registration authorities of the various states having laws regulating the practice of architecture. Its active membership is composed of such states. Its membership is not elected, but is constituted of those States whose registration authorities subscribe to its Constitution and By-Laws and pay the annual membership fee. No State which has a law regulating the practice of architecture can be denied membership in the Council, provided its legally constituted officials sign an application blank, pay the required membership fee, and deposit five copies of its Architectural Act and of the Rules and Regulations promulgated by its examining committee or board for the purpose of regulating examinations.

2. The franchise of the Council is inherent in its active members. In other words, the control of the Council is absolutely in the hands of the architectural registration authorities of the various States which are

members of the Council, each State being entitled to only one vote, even though represented by several of its officials. The officers of the Council are elected by the active members to carry out their will.

I. Reciprocal Transfer of Registration.

It is expected that architects desiring reciprocal transfer of registration credit from one State to another will find it convenient and practical to effect this transfer through the medium of the National Council of Architectural Registration Boards. In most cases where this method is followed, the applicant will be saved the necessity of a personal appearance and examination before any examining committee other than that of his home State. While the Council does not guarantee the acceptance of all applicants who apply for transfer of registration through the Council, it is in a position to, and does, furnish State examining committees with the results of an unprejudiced and disinterested investigation of the applicant's moral, educational, and legal qualifications. With this data in hand the examining au-

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thorities in the State to which the applicant desires transfer are furnished evidence which is usually considered sufficient upon which to predicate judgment as to the applicant's eligibility for registration in accordance with the laws of that State.

II. Explanation and How to Avoid Delays.

The Council fully realizes that, often, time is a very important consideration with the applicant for architectural registration or for reciprocal transfer of architectural registration, and it wishes to call architect's careful attention to some of the causes of delay and how delays may be avoided. To begin with, the applicant should appreciate the following facts:

1. Since Architectural Examining Boards, Commissions, or Committees for the various states are made up of men in private practice who serve without remuneration or at the most with a small per diem remuneration plus an allowance for actual expenses, they cannot and do not meet more often than once or twice a year; hence, if an application reaches the Secretary of such a Committee just after a meeting, there may be a long delay before the application can be taken up for consideration.

2. No Examining Commission can give intelligent consideration to an application for the transfer of registration or to the registration of an architect engaged in practice in another state where there is no law regulating the practice of architecture without a careful independent investigation of the applicant's credentials and his record in practice for reasons hereinafter set forth.

Fraud is sometimes practiced by the unscrupulous. In consequence, there is need of investigation in order to give protection to the public, also, in justice to the honest majority of applicants. The investigations conducted must be entirely independent of the applicant. In other words, diplomas, certificates, testimonial letters, etc., when submitted by the applicant may be, and are in rare cases, fraudulent. There have been cases where certificates of registration in other states have been fraudulently altered. The same is true with reference to school certificates, society memberships, and testimonial letters presented by applicants from architects and cates of registration of men long since dead have been used as a basis for reciprocal transfer by those fraudulently posing as the original registrants. For this reason, identification photographs are now being insisted upon by registration authorities in most of the states.

3. Independent investigations must be conducted largely by correspondence, often over long distances, and, in a considerable number of cases to foreign countries, thus necessarily consuming considerable time. The Council's experience in conducting these independent investigations indicates that the average time is approximately six weeks. The minimum time is never less than four weeks, and the maximum time, three to six months, particularly in the case of foreign correspondence and where inaccurate addresses are given and in the case of absent correspondents delaying replies to inquiries.

4. The evil consequences incident to the long time required for investigations can be eliminated if architects will file applications with the Council for investigations of their record before they desire transfer to any state, have the investigation completed and placed on file with the Council. Then if they suddenly wish transfer to a certain state the Council is in a position to immediately send a certified copy of an independent investigation of their record to the examining authorities of the state where they desire transfer. This record will be in such shape that it may be passed from member to member of the local Examining Committee by means of registered mail, so that their de-

cision may be secured by letter-ballot, thus avoiding the great loss of time incident to waiting for a stated meeting of an Examining Board. In this way, transfer has often been effected in time not to exceed two or three weeks. Wise men engaged in interstate business are taking this precaution and finding it advantageous. It should be universal practice.

III. Investigations by the Council.

In investigating the applicant's record, the Council writes:

- First**, to the registrars or principals of the schools where he has received his training, asking for a certified copy of his school record while in attendance upon these various institutions.

- Second**, it writes to the examining authorities of his home State for a certificate as to his registration in that State and inquiring as to whether charges have ever been preferred against him involving recklessness or carelessness in the design or supervision of buildings or dishonest practice.

- Third**, inquiry is made of his former employers, if he comes under the junior classification, concerning his record and promise as an architectural employee.

- Fourth**, inquiry is also made from at least three of his clients as to his competency and faithfulness in the execution of trusts imposed in him.

- Fifth**, inquiry is made of at least three architects as to their knowledge of the character and competency of his practice.

- Sixth**, inquiry is also made of professional and technical societies as to his membership and his record for honorable practice.

When replies to these inquiries are received, they are carefully copied and certified to by the Executive Secretary of the Council and forwarded to the examining authorities where the architect desires registration.

The Council endorses no one and expresses no opinion whatsoever. It simply collects the information and forwards it for the judgment of the local examining committee.

IV. In Applying for Council Service.

To employ the services of the Council, for the purpose of obtaining reciprocal transfer of registration credit from one state to another, request should be made of the Secretary of the National Council of Architectural Registration Boards, at 175 W. Jackson Blvd., Chicago, Illinois, for the furnishing of necessary blanks and instructions as to further procedure.

With this request should be embodied statements and enclosures in conformity with the following:

1. A par value, at Chicago, check or draft for Twenty Dollars (\$20.00) made payable to the "N. C. A. R. Boards," the required advance payment of the Council's prescribed fee to defray the expenses incident to an investigation of the applicant's record.

See Art. VIII.

2. A statement giving the state or states where the applicant is at present registered and in each case, the manner in which such registration was obtained, whether by "Exemption," "Reciprocal Exchange," "Written" or "Oral Examination"; the duration and subjects covered by each of the successful registration examinations enumerated, and the dates and official numbers of each registration.

3. A statement as to the number of years that the applicant has been engaged in the professional practice of architecture as a principal. It should be noted that employment in an architect's office as a foreman, draftsman, specification writer or superintendent is not acting as a principal or one of the principals in charge of an architect's office, neither is business as a building contractor or such contractor's superintendent, draftsman or estimator considered the practice of architecture as a principal.

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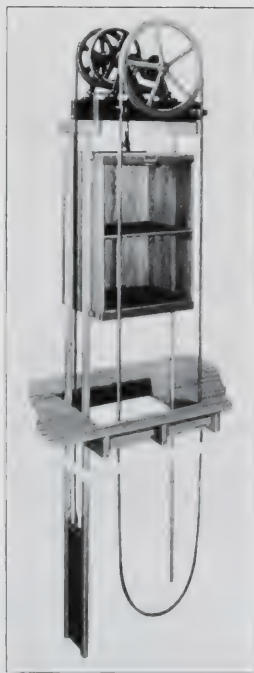


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A person may be considered a principal in the practice of architecture as a profession if he only serves a single client, on a salary or other basis, in an office maintained by such client, if it can be established that he was entirely responsible for and in complete control of the architectural work and administration of that office during the entire time enumerated "architectural practice as a principal," i. e., did he sign the work as architect and exercise control over those engaged on the design and supervision of the work executed, including the power of employment and discharge?

V. General Instructions.

1. Upon receipt of the before-mentioned statements and payment of fee, the Secretary of the National Council will forward to the applicant an "Application Blank" and an "Information Blank" which should be filled out by the applicant, certified to by a Notary Public and returned to the Council as a basis for its investigation. Too much emphasis cannot be laid on the importance of using great care in filling out the Information Blank and making the statements as completely comprehensive as space will permit.

2. Since the Information Blank must be reproduced in facsimile, it is very important that the ink used in filling in answers to the various questions shall be black opaque, susceptible to photographic or blue-print reproduction. Common drafting ink is the most practical. The typewriter may be used if the paper is backed with a fresh black carbon, so as to form a good blue-print negative. Actual dates of attendance at schools are important. Addresses of school principals, registrars, secretaries of societies, clients, and architectural references should be accurately given.

3. Much delay has resulted from failure to give this information correctly. Inaccurate or incomplete information only delays the completion of the record, as no record will be forwarded to the examining authorities of the State where the architect wishes transfer until the required number of references have been heard from.

4. Either at the time of sending the Application and Information Blanks to the applicant or at some time during the investigation of his references he will be informed by the National Council as to the amount of his preliminary fee which he must pay to the State examining authorities where he desires registration and, upon receipt of this information, he will forward to the Council a certified par value check covering the amount of that fee made out to the proper registration authorities of the State where he desires registration, as per instructions of the Council. This check will be held by the Council until applicant's record is finally completed, and will be forwarded to the State where he wishes registration along with the information collected concerning his record.

5. A film negative identification photograph of the applicant, with two (2) unmounted prints, each signed and certified to, shall be furnished the Council by the applicant at some time before its investigations are completed. Glass negatives are not acceptable.

VI. Additional Transfers.

Copies of the original credentials are preserved in the Council office and become a part of the applicant's permanent record. Should he desire to transfer to additional States, he may have this transfer facilitated through the offices of the Council by applying for a transfer in the same manner as in the case of the original application, except enclosing a fee made payable to the Council of Ten Dollars (\$10.00). In such cases, the Council will simply send a duplicate copy of his record to the additional State where applicant desires registration, except in cases where a long time has elapsed between

the original investigation and the time of application for an additional transfer. The Council will make further investigation to ascertain if the applicant has continued to maintain the high standard indicated by the original investigation. Additional information thus obtained is added to the original record and the procedure otherwise is as in the first case.

VII. Remittances to State Boards.

The best method of making remittances to State Examining authorities is by means of the certified personal check of the applicant, adding the small exchange where this is required to the amount of the check, noting on the lower left-hand corner of the check the purpose for which this check is issued. This is a very much more satisfactory method of remittance than by use of a bank draft, money order, or postal order, as, if certified, it is equally as safe to the state authorities receiving same as the bank draft.

It is no more expensive than the bank draft or postal money order, requires no longer time to secure same, presents concrete and exact evidence of payment, and the purpose for which payment is made. The applicant may then know by his returned check when his remittance has been cashed by the state to which it has been sent.

VIII. Concerning Fees.

The fees charged by the Council barely defray the expenses of its investigations. The Council is an institution organized "not for profit." All Council fees are in addition to State examining and registration fees. Should complaint be urged that the fees charged by the Council constitute an excessive burden on architectural practitioners who wish to engage in interstate business, it should be pointed out that there is no requirement compelling architects to make use of the services of the Council. They are always at liberty to appear before the examining committee of the State where they wish to be registered by reciprocal transfer, submit their proofs, and receive registration or denial of registration in that State in accordance with the merits of their case. It should be pointed out to the architects that many members of examining committees meet not more than twice a year and that some examining committees meet only once a year and that by mutual understanding registration by reciprocal transfer cannot, except in very special cases, be made between member States except on the basis of a Council investigation or by the personal appearance of the applicant before the local examining committee at one of its regular or special meetings. Transportation and hotel expense would very quickly mount up to a sum in excess of the nominal fees charged by the Council for its work, particularly, when it is borne in mind that after the first investigation subsequent fees are only Ten Dollars per transfer.

IX. Standard N. C. A. R. Examinations.

Because of its close relationship with the various examining authorities, the Council is in a position to facilitate uniformity of examinations. Where legal restrictions do not permit the local examining committees to give examinations equal in stringency, to those recommended by the Council as just and proper, the Council with the co-operation of the local examining committees may arrange voluntary examinations meeting the minimum requirements recommended by the Council. The laws in the different States vary materially and probably always will vary. Since these laws affect examinations the legal examination requirements in different States may be expected to continue to differ. Some States emphasize preliminary education as of paramount importance and place very little credence in examinations. Other States emphasize the importance of ex-

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aminations as a greater consideration than the educational record. Some States are only concerned with the question of the applicant's proficiency in matters falling under the police power of the State (i. e., the conservation of life, health and property). Other States base their requirements on broad educational standards and value aesthetic skill as equal to skill in matter of safety to human life, conservation of property and protection of health. Many requirements are common to all States. Therefore, the successful passing of an examination in any State should eliminate further requirement for an examination on work passed in the State of first examination.

The Council has devised an examination standard which it has been pleased to designate as the "Standard N. C. A. R. Examination" and which is intended to cover the minimum requirements for registration in all States. The Council suggests the advisability of supplementing the regular examination of the State of applicant's residence with this additional examination. It is understood that, while the examination is conducted under the supervision of the National Council and in strict accord with the rules promulgated by that body, it is actually conducted by the State examining committee of the State of applicant's residence. Preliminary to such examinations, the applicant must apply to the Council and have his record in practice very carefully investigated, written up, and furnished to the local examining committee as part of the material which it must use in determining the applicant's right to the status, "Registered in Accord with the Standard N. C. A. R. Examination Requirements."

The "Standard N. C. A. R. Examination" is purely a voluntary examination. No one is compelled to take it and no one will be allowed to take it who does not seem to have had adequate preparation to justify such an examination. In the interest of fair play, large discretionary power and liberal instructions are given to the examining committee in determining the equivalent of prescribed preparation.

Junior Examinations

Junior applicants (i. e., men having had less than ten years' practice as principals), who have passed the regular State examination in their home States, are only required to pass a written examination covering the difference between their home State examination requirements and those of the National Council of Architectural Registration Boards; but they must submit evidence of attainment since entering practice and evidence of attainment before practice. Of course, if they have not been engaged in practice, they will only have to submit evidence of attainment before practice. But this fact should be emphasized—that no essential part of their records from the time that they left elementary school up until the date of their applications for examination shall be missed from the investigation. Baldly stated, they must never have been found guilty of dishonorable practice, recklessness, or carelessness in connection with the designing, erection, or supervision of buildings. Their preparation for practice must be shown to have been adequate and their practical skill in applying theoretical knowledge demonstrated, both by written examination and by practical experience.

Reproductions of the applicant's work in design are made a part of the record of the National Council and furnished to the State of transfer with each application for reciprocal transfer.

Senior Examination.

The "Standard N. C. A. R. Examination for those falling under the Senior classification (i. e., men having had ten or more years'

experience as principals) is based very largely on proved attainment in practice. The Council assumes that no competent man having had ten years' experience as a directing head of an architect's office should be entitled to take the status "Registered by N. C. A. R. Examination" who cannot demonstrate to the entire satisfaction of the examining jury that he has at some time during his practice actually been engaged in the competent performance of the five fundamental functions of an architect, namely: the preparation of preliminary studies, general drawings, specifications, details, and the general supervision of the work, including all incidental items of practice which go with the performance of these various functions. With this understanding, it might be possible for a man to have had an unusually complete academic and technical school preparation and yet fail in the "Senior Standard N. C. A. R. Examination," if it should be proved that he was unable to apply or never had applied at some time during his architectural practice his theoretical knowledge in the performance of each of the fundamental functions of an architect.

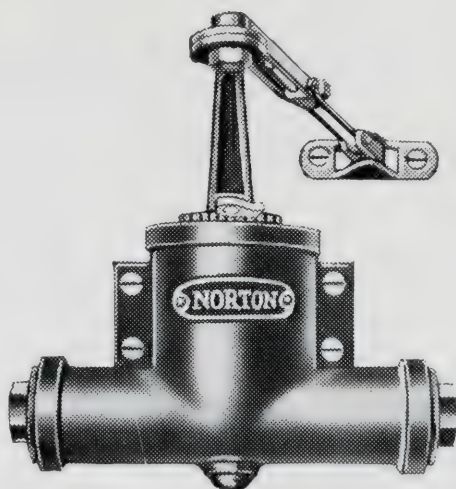
Applicant is required to furnish with his application for the "Senior N. C. A. R. Examination" eighteen illustrations at reduced size, representative of the varying character of his work. These illustrations shall be presented either in the form of photographic film negatives with two prints of each or photo-static negatives and two prints of each. The sheets are to be the architectural standard size, 8 1/2" x 11", each containing six illustrations, making a total of eighteen, on three sheets.

X. Application For Standard N. C. A. R. Examination and in General.

Should an applicant wish to take a Standard N. C. A. R. Examination he would proceed almost exactly in the same way as indicated in the foregoing upon making an application for reciprocal transfer, except that he shall include a fee of Twenty-five Dollars (\$25.00) to the Council instead of Twenty Dollars. The Council will proceed to investigate his record in exactly the same way as set forth for the investigation of record in the case of reciprocal transfer, with the following exception, that when the record is received and the copy made, the original replies and the original application and the original information cover, certified to and forwarded to the State examining authorities in the State of the applicant's residence, together with instructions to the State Examining Committee as to the additional examinations which the applicant must take, over and above the regular State examination which he has already taken, in order to qualify under the provision, "Registered by Standard N. C. A. R. Examination." In due course, the applicant will be notified to appear before his own State Examining Committee and take the prescribed examination, which, if he passes creditably, will entitle him to the status, "Registered by Standard N. C. A. R. Examination," a status which would seem to entitle him to registration in any State without further examination and which would actually be the means of securing registration in most States having laws regulating the practice of architecture. It would mean that the applicant had the endorsement of the National Council of Architectural Registration Boards.

In both Senior and Junior cases, the applicant must furnish a small identification photograph of himself which will be printed on one of the sheets illustrative of his work. Copies of these illustrations are furnished by the Council to the authorities in the State of examination and to all transfer state authorities along with a certified copy of the other records.

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LIST OF REGISTERED ARCHITECTS

Members of the Profession who will be Permitted to Practice in the State of Illinois.

Every means has been used to get a correct List of Licensed Architects who are permitted to practice Architecture in the State of Illinois for the ensuing year. The names have been compared with the Official Records of the State of Illinois as of Dec. 15, 1930.

CHICAGO

- Abel, Lester A., 7019 Merrill Ave.
 Abell, Ralph E., 176 W. Adams St.
 Abramovitz, Max, 3906 W. 15th St.
 Ablamowicz, Sigmund V., 1249 N. Ashland Ave.
 Adler, David, 220 S. Michigan Ave.
 Aga, O. W., 4229 W. Addison St.
 Ahlschlager, Walter W., 10 N. Clark St.
 Alexander, Isadore E., 64 E. Jackson Blvd.
 Allen, Alfred P., 225 N. Michigan Ave.
 Allen, James Roy, 410 S. Michigan Ave.
 Allerton, Oscar J., 541 W. Adams St.
 Allison, Lyman J., 115 S. Dearborn St.
 Almquist, Carl M., 4426 N. Mozart St.
 Alper, Max, 3235 Potomac Ave.
 Alschuler, Alfred S., 28 E. Jackson Blvd.
 Anderson, Harold E., 7449 Prairie Ave.
 Anderson, Helge A., 308 W. Washington St.
 Anderson, Helmer Nels, 5948 Midway Parkway.
 Anderson, Russell A. M., R. 1144—53 W. Jackson Blvd.
 Anderson, William C., 5220 Kenwood Ave.
 Andreson, Hans L., 643 Barry Ave.
 Anis, Albert, 108 N. Dearborn St.
 Archer, Chas. S., 9 E. 79th St.
 Armstrong, John A., 11 S. LaSalle St.
 Ashby, George William, 1511 W. Jackson Blvd.
 Ashby, Wiebert B., 1511 W. Jackson Blvd.
 Ayres, Donald P., 4507 Malden St.
 Bacci, Alexander H., 529 Aldine Ave.
 Bacon, James Earl, 7332 Phillips Ave.
 Bailey, Walter T., 3741 S. State St.
 Bannister, George S., 115 S. Dearborn St.
 Banse, Herbert G., 3811 Pine Grove Ave.
 Barfield, Norman D., 58 W. Washington St.
 Barfield, William G., 7817 Washington St.
 Bargman, Ewald F., 1408 Jarvis Ave.
 Barrett, Fred Smith, 5714 W. Ohio St.
 Barrett, Frederick L., 4354 N. Keeler Ave.
 Barry, Gerald A., 180 N. Michigan Ave.
 Barthel, Bernard, 3341 N. Hamilton Ave.
 Bartlett, Harry O., 6928 Oglesby Ave.
 Barton, Francis M., 3003 Blaine Ave.
 Baum, Isaac William, 5000 Cornell Ave.
 Baumeister, George E., 7817 Michigan Ave.
 Beach, Wilfred W., 28 E. Huron St.
 Beaudry, Ralph L., 1444 E. 65th St.
 Beck, H. Frederic, 664 N. Michigan Ave.
 Beck, Willis J., 5060 Kenmore Ave.
 Bednarik, Jos., 1643 W. Garfield Ave.
 Behrns, Elmer F., 605 N. Michigan Ave.
 Beidler, Herbert B., 936 N. Michigan Ave.
 Bein, Maurice L., 100 N. LaSalle St.
 Bellas, Charles, 617 Gary Place.
 Bennett, A. J. T., Room 779, 33 S. Clark St.
 Bennett, Edward H., 1800-80 E. Jackson.
 Benson, Arthur E., 5153 N. Clark St.
 Benson, Edward, 5153 N. Clark St.
 Berger, Bernard, 1339 Rosedale Ave.
 Berkson, Aaron, 3221 Douglas Blvd.
 Berlin, Robert C., 228 N. LaSalle St.
 Bernard, Clifford S., 10300 S. Fairfield Ave.
 Bernham, F. M., 8 S. Michigan Ave.
 Bernhard, Wilhelm, 1458 Leland Ave.
 Betts, Wm. B., 32 W. Randolph St.
 Bialles, Theo. P., 6509 Oshkosh Ave.
 Bicknell, Alfred H., 3801 N. Hoyne Ave.
 Bieg, Harry K., 4820 N. Winchester Ave.
 Bischof, Jacob H., 100 W. Monroe St.
 Bishop, Thomas R., 35 S. Dearborn St.
 Bjork, David T., 228 N. LaSalle St.
 Blake, Donald A., 7721 Colfax Ave.
 Blondin, Edward A., 1809 E. 71st St.
 Blouke, Pierre, 80 E. Jackson Blvd.
 Bodholdt, Arne, 220 S. Michigan Ave.
 Boehm, Rudolph P., 7527 Cottage Grove Ave.
 Bohasseck, Charles, 30 N. Michigan Ave.
 Bollenbacher, J. C., 333 N. Michigan Ave.
 Bonnevier, Clarence J., 8520 S. May St.
 Bouchard, Lewis C., 1905 Howard Ave.
 Bourke, Robt. E., 1401, 39 S. LaSalle St.
 Bowman, Irving H., 952 N. Michigan Ave.
 Braband, Frank J. E., 901 Wrightwood Ave.
 Brabant, Gifford, 2717 N. Kedzie Ave.
 Brand, Herbert A., 400 W. Madison St.
 Brandt, Robert, 64 E. Jackson Blvd.
 Braucher, Ernest N., 228 N. LaSalle St.
 Braun, George, Jr., 3019 N. Kenneth Ave.
 Braun, Isadore H., 19 S. LaSalle St.
 Braun, Wm. T., 58 E. Washington St.
 Bristle, Joseph H., 160 N. LaSalle St.
 Britton, Frank, 836 W. 78th St.
 Brown, Arthur Geo., 35 E. Wacker Dr.
 Brown, Arthur Robinson, R. 1461, 38 S. Dearborn St.
 Bruns, Benedict J., 1951 Irving Park Blvd.
 Brydges, E. Norman, 201 N. Wells St.
 Buchsbaum, Emanuel V., 6930 South Shore Drive.
 Buckley, Geo. H., 2237 W. 108th Place.
 Buerger, A. J., Jr., 1203 N. Karlov Ave.
 Bullock, Edwin C. A., 190 N. State St.
 Burger, Walter David, 3800 Sheridan Rd.
 Burgess, Ralph R., 7737 N. Marshfield Ave.
 Burnham, Daniel H., Jr., 160 N. LaSalle St.
 Burnham, Hubert, 160 N. LaSalle St.
 Burns, James, 205 W. Wacker Drive.
 Buss, Truman C., Jr., 7845 Eggleston Ave.
 Cabeen, Richard McP., c/o Holabird & Root, 333 N. Michigan Ave.
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 Chayes, Frank, 1334 Rosedale Ave.
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 Cohen, Joseph, 6505 Greenview Ave.
 Cohen, S. Bruce, 4316 N. Sacramento Ave.
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 Conners, William Joseph, 3328 Wilson Ave.
 Cook, Norman W., 5842 Wayne Ave.
 Cooke, Thomas E., 44 N. Waller Ave.
 Corse, Redmond O., 64 E. Lake St.
 Coughlen, Gardner C., 1923 Calumet Ave.
 Cowles, Knight C., 203 N. Wabash Ave.
 Cozad, Fred Paul, 134 N. LaSalle St.
 Crizevsky, Abe, 2642 Potomac Ave.
 Cromelin, John S., 108 E. Oak St.
 Crosby, Wm. S., 6 N. Michigan Ave.
 Crown, Samuel N., 8 S. Michigan Ave.
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 Doerr, W. Phillip, 5512 Everett Ave.
 Doerr, Wm. P., 28 E. Jackson Blvd.
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 Dowling, Edward F., 646 N. Michigan Ave.
 Drainie, John G., 7021 Jeffery Ave.
 Drielsma, Arthur J., 30 N. Dearborn St.
 Dublin, George H., 14 W. Washington St.
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 Fortin, Joseph T., 600 Blue Island Ave.
 Foster, Winslow H., 9238 Pleasant Ave.
 Fournier, Lawrence A., 5304 Kenwood Ave.
 Fox, Elmer J., 104 S. Michigan Ave.
 Fox, John J., 38 S. Dearborn St.
 Fox, William Paul, 38 S. Dearborn St.
 Foy, Wm. D., Rm. 214-600 N. Michigan Ave.
 France, Roy F., 1061 Rosemont Ave.
 Franklin, Robert L., 160 N. LaSalle St.
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 Frazier, Walter S., 75 E. Wacker Drive.
 Frederick, Erwin G., 140 S. Dearborn St.
 Freiberg, Frederick A., 6809 Cornell Ave.
 Friedman, Raphael N., 28 E. Jackson Blvd.
 Frodin, Rube S., 7359 Clyde Ave.
 Frommann, Emil H., 64 W. Randolph St.
 Frost, Charles S., 105 S. LaSalle St.
 Frost, Harry Talfourd, 1800 Railway Exch.
 Fry, Frank L., 140 S. Dearborn St.
 Fuchs, Frank Joseph, 2619 Sayre Ave.
 Fugard, John Reed, 520 N. Michigan Ave.
 Fuhrer, Eugene, 188 W. Randolph St.
 Fullenwider, Arthur E., 7209 Harvard Ave.
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 Gratiaa, S. S., 430 N. Michigan Ave.
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 Griser, Louis Keith, 2109 Leland Ave.
 Grotz, Chas. J., 3514 Wrightwood Ave.
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 Guenzel, Louis, 879 N. State St.
 Gylleck, Elmer A., 10 N. Clark St.
 Haagen, Paul T., 155 N. Clark St.
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 & Ratcliffe, 123 W. Madison St.
 Hammond, Charles Herrick, 160 N. LaSalle
 St.
 Hanselmann, Herman, 2542 Mont Clare
 Hansen, Paul, 4646 Magnolia Ave.
 Hanson, Herbert Carl, 7956 Aberdeen St.
 Happell, Otto Gottlieb, 568 Arlington Place.
 Harlev, William H., Jr., 64 W. Randolph St.
 Harris, Mandel H., 80 W. Washington St.
 Haselhuhn, Robert G., 6413 N. Leavitt St.
 Hatzfeld, Clarence, 7 S. Dearborn St.
 Hauber, Carl, 25 E. Jackson Blvd.
 Hawk, A. T., 806 LaSalle St., R. R. Station.
 Hecht, Albert S., 109 N. Dearborn St.
 Heda, Arthur M., 3011 N. Halsted St.
 Hegsted, Martin A., 1249, 80 E. Jackson Blvd.
 Heimbeck, Walter C., 1736 W. 102nd St.
 Henderson, Charles C., 105 S. LaSalle St.
 Henshien, H. Peter, 59 E. Van Buren St.
 Herter, John T., 2638 Fargo Ave.
 Hetherington, John T., 33 S. Clark St.
 Hetherington, Murray D., 33 S. Clark St.
 Hettinger, Robert J., 4708 Dover St.
 Heun, Arthur, 6 N. Michigan Ave.
 Higgins, Edgar J. S., 7628 Bosworth Ave.
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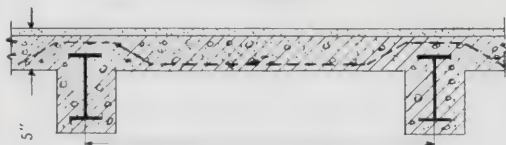
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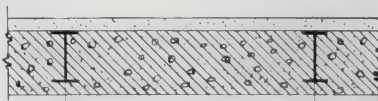
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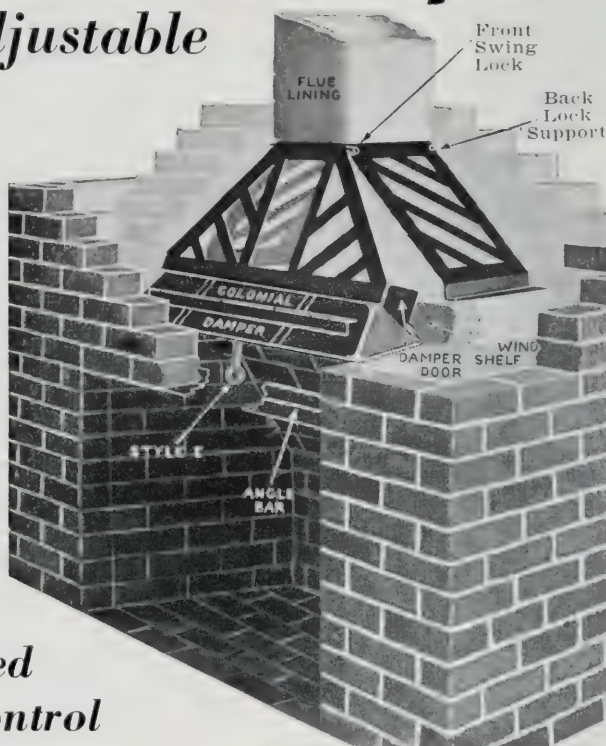
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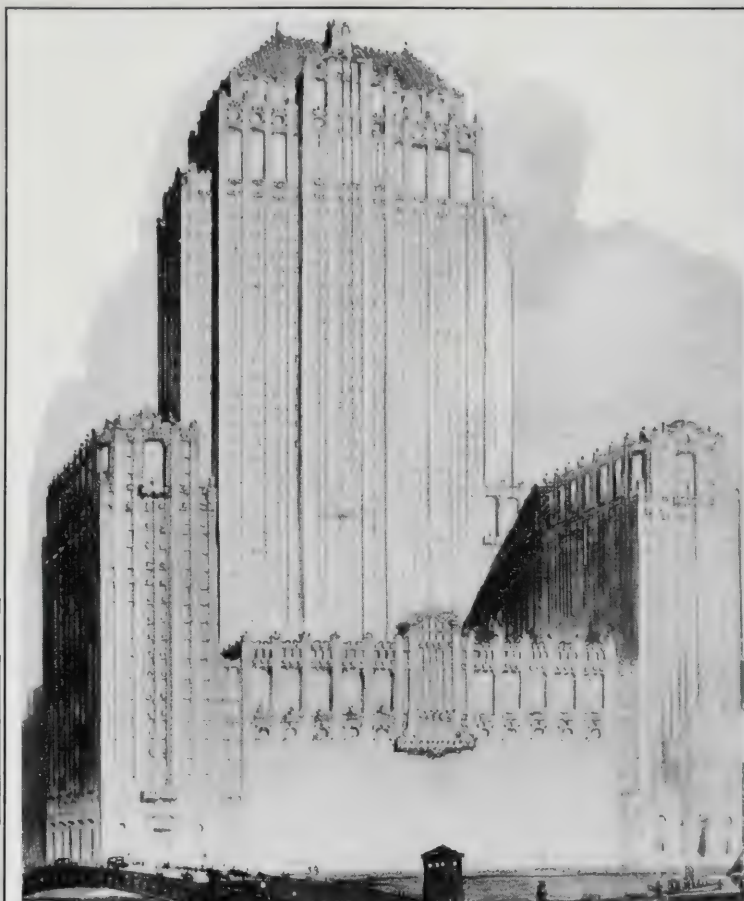
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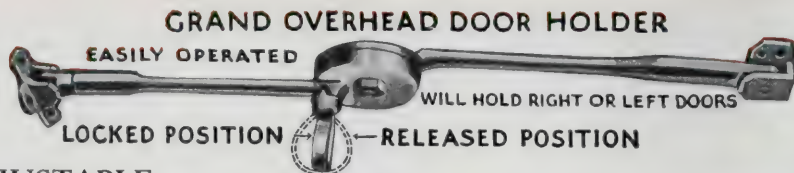
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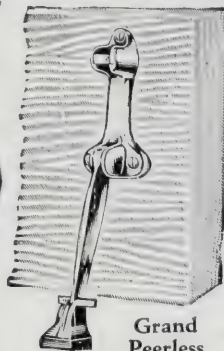
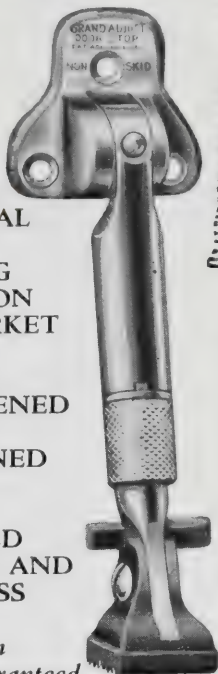


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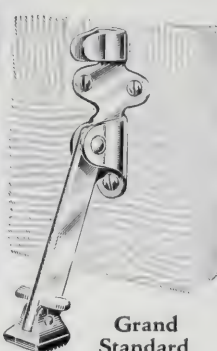
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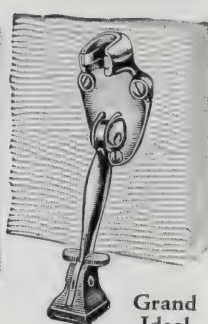
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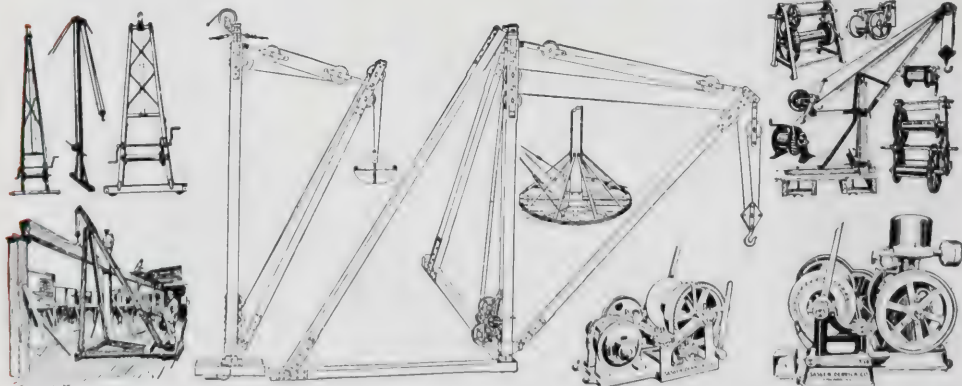
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 H. L. Palmer, Financial Secretary.

1917

Stafford Fox Thomas, President.
 Arthur F. Hussander, 1st Vice-President.
 James B. Dibelka, 2d Vice-President.
 Samuel N. Crowen, Treasurer.
 John Reed Fugard, Secretary.
 H. L. Palmer, Financial Secretary.

1918

George W. Maher and Arthur F. Hussander,
 Presidents.
 Arthur F. Hussander, President.
 James B. Dibelka, 1st Vice-President.
 George W. Maher, 2nd Vice-President.
 Samuel N. Crowen, Treasurer.
 George A. Knapp, Secretary.
 H. L. Palmer, Financial Secretary.

1919

Charles Herrick Hammond, President.
 Robert C. Berlin, 1st Vice-President.
 N. Max Dunning, 2nd Vice-President.
 John A. Armstrong, Treasurer.
 Ralph C. Harris, Secretary.
 H. L. Palmer, Financial Secretary.

1920

Frank E. Davidson, President.
 Herbert E. Hewitt, 1st Vice-President.
 John A. Nyden, 2nd Vice-President.
 John A. Armstrong, Treasurer.
 Ralph C. Harris, Secretary.
 H. L. Palmer, Financial Secretary.

1921

Frank E. Davidson, President.
 Herbert E. Hewitt, 1st Vice-President.
 John A. Nyden, 2nd Vice-President.
 John A. Armstrong, Treasurer.
 Ralph C. Harris, Secretary.
 H. L. Palmer, Financial Secretary.

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 William P. Fox, 1st Vice-President.
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 Park, Ill.
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 Ashby, Wilbert B., 1511 W. Jackson Blvd.

1922

Frank E. Davidson, President.
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 Herbert E. Hewitt, 2nd Vice-President.
 Robert C. Ostergren, Treasurer.
 Ralph C. Harris, Secretary.
 H. L. Palmer, Financial Secretary.

1923

Charles E. Fox, President.
 Byron H. Jillson, 1st Vice-President.
 Herbert E. Hewitt, 2nd Vice-President.
 Robert C. Ostergren, Treasurer.
 Ralph C. Harris, Secretary.
 H. L. Palmer, Financial Secretary.

1924

Charles E. Fox, President.
 Byron H. Jillson, 1st Vice-President.
 Frank A. Carpenter, 2nd Vice-President.
 Robert C. Ostergren, Treasurer.
 Ralph C. Harris, Secretary.
 H. L. Palmer, Financial Secretary.

1925

Charles E. Fox, President.
 Byron H. Jillson, 1st Vice-President.
 Frank A. Carpenter, 2nd Vice-President.
 Robert C. Ostergren, Treasurer.
 Ralph C. Harris, Secretary.
 H. L. Palmer, Financial Secretary.

1926

Leon E. Stanhope, President.
 Byron H. Jillson, 1st Vice-President.
 George B. Helmle, 2nd Vice-President.
 Robert C. Ostergren, Treasurer.
 Ralph C. Harris, Secretary.
 H. L. Palmer, Financial Secretary.

1927

Leon E. Stanhope, President.
 Howard J. White, 1st Vice-President.
 George B. Helmle, 2nd Vice-President.
 Robert C. Ostergren, Treasurer.
 Walter A. McDougall, Secretary.
 H. L. Palmer, Financial Secretary.

1928

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 Robert S. De Golyer, 1st Vice-President.
 George B. Helmle, 2nd Vice-President.
 Robert J. Ostergren, Treasurer.
 Walter A. McDougall, Secretary.
 H. L. Palmer, Financial Secretary.

1929

Robert C. Ostergren, Treasurer.
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OFFICE PRACTICE

By Illinois Society of Architects.

Believing that uniform practice in various architects' offices is desirable for all concerned, this Society recommends that the following conditions prevail in architects' offices of the State of Illinois:

Classification of Employees.

First. That employes be classed as Regular and Special;

Second. Employes classified as "Regular" will be those continually engaged for a period of not less than one year, on a weekly salary basis; it is expected that such employes will assume greater responsibilities to their employers and be granted special privileges, in consideration of faithful service;

Third. Employes classified as "Special" will be those engaged temporarily. It is deemed proper that such employes be paid by the hour for actual service rendered, making no allowance for vacations or holidays, it being considered fair under these circumstances to allow these draughtsmen a slightly higher rate per hour than regular employes who enjoy privileges of vacations and holidays.

Office Hours.

First. It is understood that draughtsmen are expected to be in their respective offices ready to begin actual work at the hours stated, and that they will continue in service at least until the hours fixed for cessation of work;

Second. The regular opening time of offices shall be 8:30 A. M., throughout the year;

Third. Period of service for Monday, Tuesday, Wednesday, Thursday and Friday, in the morning, shall be four hours, extending to 12:30 P. M., that the lunch hour shall be one hour, extending from 12:30 to 1:30 P. M.; that the afternoon period shall be four hours, extending from 1:30 to 5:30 P. M.;

Fourth. That the Saturday period of service shall consist of 4½ hours, extending from 8:30 A. M. continuously to 1:00 P. M.

Units of Service.

First. One week's service will consist of 44½ hours;

Second. One year's service will consist of 2,180½ hours.

Pay-Day.

First. That pay-day shall be on Monday of every week;

Second. That each pay-day draughtsmen be paid up to the Saturday night preceding.

Holidays and Vacations.

First. We recommend that "Regular" draughtsmen be given the following holidays on full pay: New Year's, Decoration Day, July Fourth, Labor Day, Thanksgiving, Christmas;

Second. That all "Regular" draughtsmen having been in the employ of an architect for more than one year be given two weeks' vacation on full pay, at time most convenient for employer;

Third. It should be understood that "Regular" draughtsmen, quitting the employer's service of their own volition, preceding the completion of any year's service, shall not be entitled to vacation allowance;

Fourth. "Regular" employes terminating service at the request of their employer shall be entitled to an allowance in cash proportionate to two weeks' salary allowed for vacation in the same ratio as period of service bears to one year;

Fifth. Vacations and holidays are understood to be granted to employes for rest and recuperation, the employe being understood to be in the service of the employer during vacation and holiday time just to the same extent as when regularly engaged in the office;

Sixth. It is recognized that an average of 44½ hours per week's service is the maximum efficient service that can be continuously rendered without detriment to the health or efficiency of the employe, and that where the employe engages in outside architectural service of any sort for others, he does so at the expense of his employer, and his employer should be credited for corresponding loss of time. The practice of employes of one employer working nights or holidays for another is condemned as detrimental to the best interests of both employer and employe;

Seventh. In case of emergencies of short duration, "Regular" employes are expected to work over-time for the employer without extra remuneration other than a reasonable allowance for the expense of taking meals away from regular lodging place. In such cases, however, the employes will be credited with off time on account of sickness or otherwise, equivalent to the amount of over-time service rendered in cases of emergency;

Eighth. Draughtsmen are encouraged, however, to make use of a portion of their time off for educational improvement.

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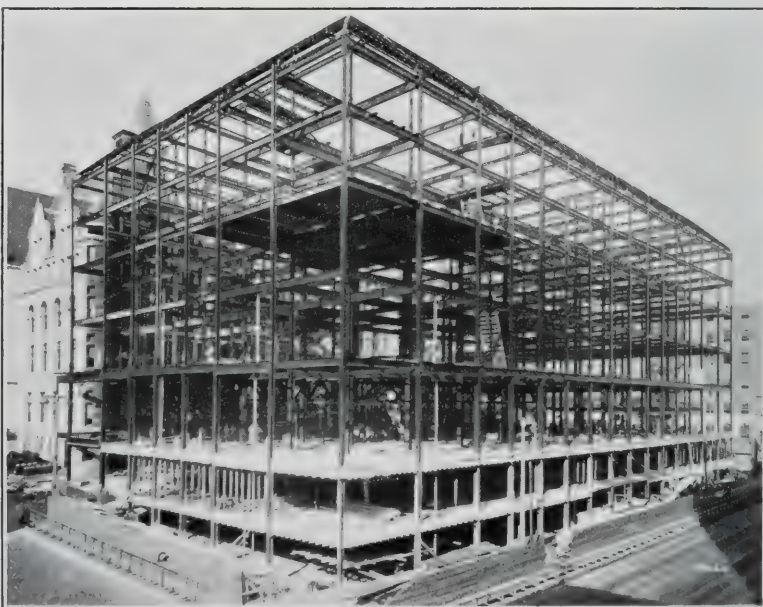
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SUGGESTIONS FOR FIRMS ISSUING CATALOGUES AND PRINTED MATTER

Architects are technically educated and are charged with selection on technical merit.

Exact and specific technical detail appeals to an architect because it enables him to judge quickly and correctly.

Drawings to scale of parts or the whole make arrangement or mechanism most quickly clear to the technically educated.

Testimonials from those technically incompetent to judge carry no weight with the competent.

Architects want authentic technical information about all building materials and devices.

Architects do not want to wade through a sea of laudatory verbiage in order to discover an islet of real usable information.

Architects must cover an immense variety and amount of detail in selecting the numerous materials that enter into a building.

Where much detail is handled by a single individual, success is dependent on system.

Information to be immediately available for architects must be classified so that each detail can be considered separately and in order.

Advertisers recognizing these principles and presenting exact technical information under proper classification, free from irrelevant matter and in convenient form for filing, so as to be available when that item is up for consideration, are most likely to secure satisfactory results from their efforts.

It is believed that most architects have their own particular system of filing and classification and would not take kindly to any advertising scheme contemplating the placing of filing cabinets in architects' offices and distribution by those interested in the promotion of advertising scheme. Architects do not take kindly to allowing outsiders access to their private catalogue filing cabinets, and it is impractical to have two filing systems in the same office.

Practical requirements in the preparation of specifications make it necessary for architects to divide their specifications into topics very similar to trade divisions brought about by divisions of labor promulgated by labor authorities, and no single division or chapter of a catalogue should contain matter pertaining to more than one trade; un-

less the material referred to is used by several trades. It is hoped that eventually the architects may agree on a satisfactory universal building material classification or index. But it is certain that this time has not yet arrived and that no person not actually having had extended experience in the preparation of architects' specifications is capable of preparing such an index that would be practical.

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Believing that uniform practice by the various publishers of catalogues and literature for distribution to architects is desirable for all concerned, and wishing to be in accord with the recommendations of the American Institute of Architects, the Illinois Society of Architects advise that all literature for this purpose be prepared to comply as nearly as possible with the conditions set forth, as follows:

First: That $8\frac{1}{2}" \times 11"$ shall be the standard sized page for all general catalogues and bulletins intended for permanent filing by architects; thus making a size convenient for filing in the standard letter-size vertical filing cabinets, such as may be procured from any concern dealing in office filing devices.

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Fourth: That it is important to have pages cut to exact size; if over size in any particular they may not go into files; if under size, they may be overlooked in running through the files hastily.

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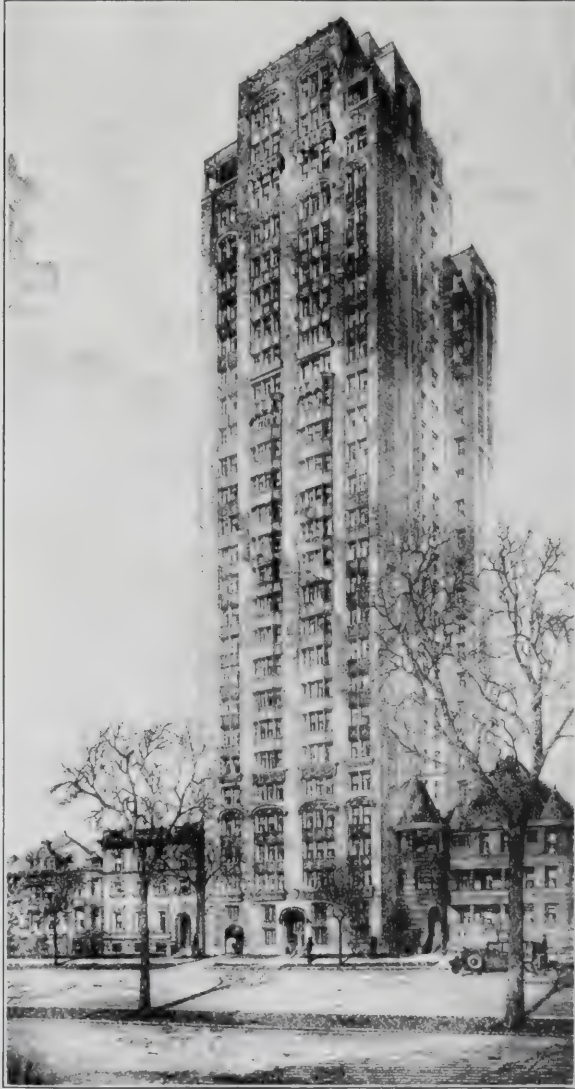
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end.

Architect, City, 10th floor, R. 1012, south end.
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R. 202-A, north end.

Board of Election Commissioners, 3rd floor,
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south end.

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702, 1125 S. State St.

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General Offices, 2nd floor, R. 207, south
end.

Public Hearing Room, 1st floor, R. 104,
north end.

Law Department, 2nd floor, R. 207, south
end.

Boiler Inspection, R. 601.

Buildings, Department of, 7th floor, R. 702,
north end.

Bridge Division, 4th floor, R. 402, north end.

Business Agent, vault floor, north end.

City Attorney, 6th floor, R. 601, north end.

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Paymaster, R. 501.

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202, north end.

Committee on Finance, 3rd floor, R. 302,
north end.

Committee on Local Transportation, 2nd
floor, north end.

Committee on Gas, Oil and Electric Light,
2nd floor, north end.

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City Forester, 10th floor, R. 1004, north end.

City Hall:

Engineer, basement, south end.

Chief Janitor, basement.

City Sealer, R. 608, south end.

City Treasurer, 2nd floor, center.

Civil Service Commission:

General Offices, 6th floor, R. 610, south
end.

Examining Room, 10th floor, R. 1006, cen-
ter.

Trial Room, R. 612.

Compensation, Dept. of, R. 302, north end.

Corporation Counsel, 5th floor, R. 511, south
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Dog Pound, W. 29th St. and S. Sacramento
Ave.

Education, Board of.

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floor, R. 402-4, north end.

Election Commissioners, Board of, 3rd floor,
R. 308, center.

Electricity, Department of, 6th floor, R. 614,
south end.

Electrical Inspection Bureau, R. 606.

Electrical Supervisor, R. 613, south end.

Fire Department:

Fire Marshal, 1st floor, R. 105, north end

Fire Alarm Telegraph, 6th floor, R. 607,
center.

Firemen's Pension Fund, Secretary of
Board of Trustees (City Clerk), 1st
floor, R. 107, south end.

Department Attorney, 1st floor, R. 105,
south end.

Fire Prevention, Bureau of, 1st floor, R. 105,
north end.

Gas & Electricity, Dept. of, R. 614, center.

Gas, Oil & Electric Light, Committee on,
2nd floor, north end.

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Harbor Board, R. 406, south end.

Harbor Master, Municipal Pier.

Health, Department of, 7th floor.

Commissioner of Health, R. 710.

Bureau of Food Inspection, 704.

Bureau of Sanitary Inspection, R. 704.

Bureau of Contagious Diseases, R. 707.

Bureau of Vital Statistics, R. 707.

Complaint Division, R. 704.

Plan Examination, R. 704.

Child Welfare, R. 707.

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Law, Department of:

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south end.

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Prosecuting Attorney, 6th floor, R. 604,
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south end.

Library, Chicago Public, N. Michigan Ave.
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Library, Municipal Reference, 10th floor,
R. 1005, north end.

License Department, 1st floor, R. 111.

Local Transportation, Committee on, 2nd
floor, north end.

Maps and Plats, Bureau of, 4th floor, R.
410, south end.

Mason Contractors, Board of Examiners of,
R. 1008, south end.

Mayor's Office, 5th floor, R. 507, center.

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Municipal Lodging House, 162 N. Union Ave.

Municipal Pension Fund, 3½ (vault) floor, R. 15.

Municipal Pier, foot of East Grand Ave.

Municipal Reference Library, 10th floor, R. 1005, north end.

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Special Assessments (Board of Local Improvements), 2nd floor, R. 207, south end.

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Court Service Division,
1130 County Bldg.
Mrs. Margaret Donar, Assistant Director.

RECORDER OF DEEDS:

Clayton F. Smith,
1st floor, south end

REGISTRAR OF TITLES (Torrens System):

Clayton F. Smith,
R. 1010, 10th floor.

REVIEW, BOARD OF:

R. 337, 3rd floor.

RURAL PUBLIC HEALTH NURSES OF COOK COUNTY:

R. 922.

SHERIFF:

William D. Meyering,
R. 423, 4th floor.

STATE'S ATTORNEY:

John A. Swanson,
Criminal Court building, 26th St. and
California Ave.
Cook County Law Department.
R. 507, 5th floor.

SUPERIOR COURT:**Judges:**

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Hon. Worth E. Caylor,
Hon. Joseph B. David,
Hon. Joseph H. Fitch,
Hon. Martin M. Gridley,
Hon. Oscar Hebel,
Hon. Marcus Kavanagh,
Hon. Harry A. Lewis,
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Hon. R. F. Desort,
Hon. R. C. Hall,
Hon. Peter H. Schwaba.

Clerk:

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R. 437, 4th floor.

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R. 519, 5th floor.

SURVEYOR:

William Kramer,
R. 726, 7th floor.

TAX EXTENSION DEPARTMENT:

Joseph Ziemba, Chief.
R. 217, 2nd floor.

TORRENS SYSTEM:

Clayton F. Smith, Registrar,
1st floor, south end.

COUNTY ARCHITECT:

Eric E. Hall.
R. 2100, 123 W. Madison St.

CLERK OF CRIMINAL COURT:

George Seif,
Criminal Court building, 26th St. and
California Ave.



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Graham, Anderson, Probst & White, Architects

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CHICAGO

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WM. D. SALTIEL.....	City Attorney.
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23RD WARD	JOHN TOMAN, 4056 W. 21st Pl.....	Lawndale 5169
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Chicago, Ill.

MEMBERSHIP OF COUNCIL COMMITTEES

1929-1931

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—CLARK (Chairman), Anderson, Cronson, Guernsey, Govier, McDonough, O'Toole, Byrne, Moran, D. A. Horan, Arvey, J. B. Bowler, Maypole, Smith, Seif, Crowe, Nelson, Hoellen.

Local Transportation. Meets on Fridays

at 2:00 P. M.—McDONOUGH (Chairman), Jackson, Cronson, Guernsey, Meyering, Rowan, Wilson, O'Toole, Byrne, Moran, Cepak, Toman, Arvey, J. B. Bowler, A. J. Horan, Smith, Seif, T. J. Bowler, Loescher, Feigenbutz, Nelson.

Gas Oil and Electric Light. Meets on Fri-

days at 11:00 A. M.—ARVEY (Chairman), Jackson, Cronson, Meyering, Wilson, McDonough, O'Toole, Moran, Coyle, Cepak, Loescher, Feigenbutz, Nelson, Hoellen, Williston.

Judiciary and Special Assessments. Meets

on Thursdays at 10:30 A. M.—NELSON (Chairman), Coughlin, Jackson, Cronson, Govier, Wilson, McDonough, Northrup, Toman, Arvey, J. B. Bowler, Leahy, Maypole, A. J. Horan, Konkowski, Seif, Taylor, Ross, Feigenbutz, Massen, Mellin.

Efficiency, Economy and Rehabilitation.

Meets on Thursdays at 2:00 P. M. CRONSON (Chairman), Guernsey, Nance, Rowan, Morris, Pacelli, D. A. Horan, Maypole, A. J. Horan, Konkowski, Smith, Rozczynialski, Nusser, Taylor, Landmesser, Hoellen, Massen.

Local Industries, Streets and Alleys. Meets

on Tuesday at 10:30 A. M.—D. A. HORAN (Chairman), Coughlin, Anderson, Wilson, O'Toole, Byrne, Moran, Coyle, Pacelli, Toman, J. B. Bowler, Sloan, Leahy, Kaindle, Nusser, Landmesser, Ringa, Ross, Loescher, Feigenbutz, Mellin.

Railway Terminals. Meets on Mondays at

2:00 P. M.—KAINDL (Chairman), Anderson, Jackson, Cronson, Eaton, Guernsey, Nance, Meyering, Northrup, Cepak, Toman, Maypole, Rozczynialski, Seif, Nusser, Albert, Loescher, Nelson, Hoellen, Massen.

Buildings and Zoning. Meets on Mondays

at 10:30 A. M.—O'TOOLE (Chairman), Coughlin, Jackson, Govier, Rowan, Wilson, Zintak, Coyle, Morris, Northrup, Pacelli, Cepak, Leahy, A. J. Horan, Smith, Nusser, Ringa, Ross, T. J. Bowler, Crowe, Nelson, Mellin.

Harbors Wharves and Bridges. Meets

subject to call of Chairman.—GUERNSEY (Chairman), Coughlin, Nance, Meyering, Govier, Rowan, Zintak, Coyle, Morris, Northrup, Pacelli, Maypole, Smith, Ringa, Crowe, Albert.

Track Elevation. Meets on Fridays at 10:00

A. M.—A. J. HORAN (Chairman), Coughlin, Anderson, Eaton, Nance, Govier, Rowan, Wilson, McDonough, Moran, Coyle, Northrup, Pacelli, Sloan, Maypole, Konkowski, Taylor, Ringa, Crowe, Massen.

Schools, Fire and Civil Service. Meets sub-

ject to call of Chairman.—HOELLEN (Chairman), Anderson, Govier, Zintak, Northrup, D. A. Horan, Toman, Sloan, Konkowski, Landmesser, Ross, T. J. Bowler, Crowe, Albert, Feigenbutz, Williston, Mellin.

Traffic Regulation and Public Safety. Meets

on Thursdays at 2:30 P. M.—T. J. BOWLER (Chairman), Coughlin, Eaton, Nance, Zintak, McDonough, Coyle, Morris, Cepak Maypole, A. J. Horan, Konkowski, Rozczynialski, Kaindle, Albert, Loescher, Feigenbutz, Hoellen, Massen, Williston.

Public Health. Meets subject to call of

Chairman.—MORAN (Chairman), Eaton, Nance, Meyering, Zintak, Morris, Pacelli, Sloan, Leahy, Rozczynialski, Taylor, Ringa, Ross, Albert, Massen, Mellin.

Police and Municipal Institutions. Meets

subject to call of Chairman.—BYRNE (Chairman), Anderson, Jackson, Cronson, Govier, Morris, Pacelli, Cepak, Toman, J. B. Bowler, Konkowski, Rozczynialski, Taylor, Leahy, Landmesser, J. Bowler, Loescher, Feigenbutz, Williston, Mellin.

Parks, Playgrounds, Aviation and Athletics.

Meets subject to call of Chairman.—CROWE (Chairman), Eaton, Meyering, Rowan, Zintak, Byrne, D. A. Horan, Sloan, A. J. Horan, Rozczynialski, Kaindle, Ross, T. J. Bowler, Albert, Loescher.

Conventions. MAYPOLE (Chairman), Mor-

ris, Clark, Kaindle, Crowe.

Committees and Rules. Meets subject to

call of Chairman.—McDONOUGH (Chairman), (alternate, O'TOOLE), Cronson (alternate, Coughlin), Clark (alternate, A. J. Horan), Seif, Nelson (alternate).

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MECHANICS LIEN LAW

State of Illinois

1. "Contractor" defined—lien upon real estate for material or labor furnished.
2. Liens for labor or material furnished by mistake.
3. Husband and wife.
4. Breach of contract by owner—recovery of material—other provisions.
5. Claims of sub-contractor—notice of to owner—owner's duty—contractor's liability—exceptions.
6. Time for completing contract.
7. Limitation as against third parties—claim for lien—proof of delivery sufficient.
8. Assigning liens or claims for liens.
9. Suit—how brought—joint suits—cross bill—dismissal—surprise—limitation.
10. Personal representatives—death of parties in interest.
11. "Parties in interest" defined—dismissal—notice.
12. Practice—powers of court—receivers.
13. Practice—answer—defense—counter claim.
14. Trials—delay—order for sale.
15. Preferences.
16. Incumbrances—pro rata benefits.
17. Costs—attorney fees.
18. Sales of estates—partial sales.
19. Proceeds of sale—application—preferences—deficiency and surplus.
20. Redemption.
21. "Sub-contractor" defined—preferences—limit of ability—abandonment of contract.
22. Partner after contract—statement of sub-contractor—failure—penalty.
23. Lien against public funds—public improvements—liability and duty of official.
24. Notice by sub-contractor—agents, architects and superintendents to be notified—form of notice.
25. Notice to non-residents.
26. Preferential liens.
27. Owners' duty after notice—preferences.
28. Suits by sub-contractor—proceedings.
29. Judgment before justice—transcript—executions.
30. General settlement—procedure.
31. Failure to complete contract—owner's liability to sub-contractor.
32. Wrongful payment of owner to contractor.
33. Limitation as to suit of sub-contractor.
34. General provisions.
35. Neglect—penalty.
36. Wrongful sale or removal of material—penalty.
37. Liens against water craft.
38. Filing claims—circuit clerk's duties—fees.
39. Construction of Act.
40. Repeals of Act of 1895.

AN ACT

To Revise the Law in Relation to Mechanics' Liens; To Whom, What For and When Lien Is Given; Who Is a Contractor; Area Covered by and Extent of Lien; When the Lien Attaches. (Approved May 18, 1903; in Force July 1, 1903; as Amended by Act Approved June 16, 1913, in Force July 1, 1913.)

Section 1. **When Lien Given.** Be it Enacted by the People of the State of Illinois, Represented in the General Assembly: That any person who shall by any contract or contracts, express or implied, or partly expressed or implied, with the owner of a lot or tract of land, or with one whom such owner has authorized or knowingly permitted to contract for the improvement of, or to improve the same, furnish material, fixtures, apparatus or machinery, forms or form work used in the process of construction where cement, concrete or like material is used for the purpose of or in the building, altering, repairing or ornamenting any house or other building, walk or sidewalk, whether such walk or sidewalk be on the land or bordering thereon, driveway, fence or improvement or appurtenances thereto on such lot or tract of land or connected therewith, and upon, over or under a sidewalk, street or alley adjoining; or fill, sod or excavate such lot or tract of land, or do landscape work thereon or therefor; or raise or lower any house thereon or remove any house thereto; or perform services as an architect or as a structural engineer for any such purpose; or furnish or perform labor or services as superintendent, timekeeper, mechanic, laborer or otherwise, in the building, altering, repairing or ornamenting of the same; or furnish material, fixtures, apparatus, machinery, labor or services, forms or form work used in the process of construction where concrete, cement or like material is used, on the order of his agent, architect, structural engineer or superintendent having charge of the improvements, building, altering, repairing or ornamenting the same, shall be known under this Act as a contractor, and shall have a lien upon the whole of such lot or tract of land and upon the adjoining or adjacent lots or tracts of land of such owner constituting the

same premises and occupied or used in connection with such lot or tract of land as a place of residence or business; and in case the contract relates to two or more buildings, on two or more lots or tracts of land, upon all such lots and tracts of land and improvements thereon for the amount due to him for such material, fixtures, apparatus, machinery, services or labor, and interest from the date the same is due. This lien shall extend to an estate in fee, for life, for years, or any other estate or any right of redemption, or other interest which such owner may have in the lot or tract of land at the time of making such contract or may subsequently acquire therein, and shall be superior to any right of dower of husband or wife in said premises, provided the owner of such dower interest had knowledge of such improvement and did not give written notice of his or her objection to such improvement before the making thereof; nor shall the taking of additional security by the contractor or sub-contractor be a waiver of any right of lien which he may have by virtue of this Act, unless made a waiver by express agreement of the parties; and this lien shall attach as the date of the contract. (As amended by Act approved June 28, 1919.)

Section 2. **Liens for Work or Materials by Mistake Put Upon Land Other Than the Contracting Parties.** Any person furnishing services, labor or material for the erection of a building, or structure, or improvement, by mistake, upon land owned by another than the party contracting as owner, shall have a lien for such services, labor or material upon such building, or structure, or improvement, and the court, in the enforcement of such lien, shall order and direct such building, structure or improvement to be separately sold under its decree, and the purchaser may remove the same within such reasonable time as the court may fix.

Section 3. **Liens for Work or Materials Under Contract with Husband on Land of Wife.** If any such services or labor are performed upon or materials are furnished for lands belonging to any married woman, with her knowledge and not against her protest in writing, as provided in Section 1 of

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CHICAGO

this Act, in pursuance of a contract with the husband of such married woman, the person furnishing such labor or materials shall have a lien upon such property, the same as if such contract had been made with (the) married woman, and in case the title to such lands upon which improvements are made is held by husband and wife jointly, the lien given by this Act shall attach to such lands and improvements, if the improvements be made in pursuance of a contract with both of them, or in pursuance of a contract with either of them, and in all such cases no claim of homestead right set up by a husband or wife shall defeat the lien given by this Act.

Section 4. Breach of Contract by Owner—Recovery for Material—Partial Performance—Quantum Meruit—Right to Reclaim—Un-used Material.) When the owner of the land shall fail to pay the contractor moneys justly due him under the contract at the time when the same should be paid, or fails to perform his part of the contract in any other manner, the contractor may discontinue work, and the contractor shall not be held liable for any delay on his part during the period of, or caused by, such breach of contract on the part of the owner; and if, after such breach for the period of ten days, the owner shall fail to comply with his contract, the contractor may abandon the work, and in such case the contractor shall be entitled to enforce his lien for the value of what has been done, and the court shall adjust his claim and allow him a lien accordingly. In such cases all persons furnishing material which has not been incorporated in the improvement shall have the right to take possession of and remove the same if he so elects.

Section 5. Contractors to Notify Owners of Sub-Contracts and Amounts of Their Claims—Owner's Duty with Regard Thereto and Rights in Case of Default—Contractor's Liability for Failure to Give Statement—Contractors to Whom This Section Does Not Apply.) It shall be the duty of the contractor to give to the owner, and the duty of the owner to require of the contractor, before the owner or his agent, architect or superintendent, shall pay or cause to be paid to said contractor or to his order any moneys or other consideration due or to become due such contractor, or make or cause to be made to such contractor any advancement of any money or any other consideration, a statement in writing, under oath or verified by affidavit, of the names of all parties furnishing materials and labor, and of the amounts due or to become due each. Merchants and dealers in materials only shall not be required to make statements herein provided for.

Section 6. Time for Completion of Contract.) In no event shall it be necessary to fix or stipulate in any contract a time for the completion or a time for payment in order to obtain a lien under this Act: Provided, that the work is done or material furnished within three years from the commencement of said work or the commencement of furnishing said materials.

Section 7. Limitations as Against Third Parties—Claim for Lien—What Shall Consist of—When Claim May be Filed and When Amended—As to Errors in—Proof of Delivery of Material, Not Use, Sufficient—Delivery of Material at One Building Good for All Buildings.) No contractor shall be allowed to enforce such lien against or to the prejudice of any other creditor or incumbrancer or purchaser, unless within four months after completion, or if extra or additional work is done or material is delivered thereafter within four months after the completion of such extra or additional work or the final delivery of such extra or additional material, he shall either bring suit to enforce his lien therefor or shall file with the clerk of the Circuit Court in the county in which the building, erection or other improvement to

be charged with the lien is situated, a claim for lien, verified by the affidavit of himself, or his agent or employee, which shall consist of a brief statement of the contract, the balance due after allowing all credits, and a sufficiently correct description of the lot, lots or tracts of land to identify the same. Such claim for lien may be filed at any time after the contract is made, and as to the owner may be filed at any time after the contract is made and within two years after the completion of said contract, or the completion of any extra work or the furnishing of any extra material thereunder, and as to such owner may be amended at any time before the final decree. No such lien shall be defeated to the proper amount thereof because of an error or overcharging on the part of any person claiming a lien therefor under this Act unless it shall be shown that such error or overcharge is made with intent to defraud; nor shall any such lien for material be defeated because of lack of proof that the material after the delivery thereof, actually entered into the construction of such building or improvement, although it be shown that such material was not actually used in the construction of such building or improvement: Provided, it is shown that such material was delivered either to said owner or his agent for such building or improvement, to be used in said building or improvement, or at the place where said building or improvement was being constructed, for the purpose of being used in construction or for the purpose of being employed in the process of construction as a means for assisting in the erection of the building or improvement in what is commonly termed forms or form work where concrete, cement or like material is used, in whole or in part: And, provided, further, that in case of the construction of a number of buildings under contract between the same parties, it shall be sufficient in order to establish such lien for material, if it be shown that such material was in good faith delivered at one of the said buildings for the purpose of being used in the construction of any one or all of such buildings, or delivered to the owner or his agent for such buildings, to be used therein; and such lien for such material shall attach to all of said buildings, together with the land upon which the same are being constructed, the same as in a single building or improvement: And, provided, further, that in the event the contract relates to two or more buildings on two or more lots or tracts of land, then all of said buildings and lots or tracts of land may be included in one statement of claim for a lien. (As amended by Act approved June 16, 1913, in force July 1, 1913.)

Section 8. Assignability of Liens or Claims for Liens—Rights of Assignee.) All liens or claims for lien which may arise or accrue under the terms of this Act shall be assignable, and proceedings to enforce such liens or claims for lien may be maintained by and in the name of the assignee, who shall have as full and complete power to enforce the same as if such proceedings were taken under the provisions of this Act by and in the name of the lien claimant.

Section 9. When, How and in What Court Suit May be Brought—Two or More Lien Holders May Join in Bringing Suit—Answers Stand as Cross-Bills—Original Bill Cannot be Dismissed Without Consent of Parties—Lien Claimants May Contest Each Other's Claims Without Formal Issues of Record—Rights of in Case of Surprise—Limitation.) If payment shall not be made to the contractor having a lien by virtue of this Act of any amount due when the same becomes due, then such contractor may bring suit to enforce his lien by bill or petition in any court of competent chancery jurisdiction in the county where the improvement is located, and in the event that the contract relates to two or more buildings or two or more lots or tracts of land, then all of said buildings and lots or tracts of land may be in-

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cluded in one bill or petition. Any two or more persons having liens on the same property may join in bringing such suit, setting forth their respective rights in their bill or petition; all lien claimants not made parties thereto may, upon application, become defendants and enforce their liens by answer to the bill or petition in the nature of an intervening petition, and the same shall be taken as a cross-bill against all the parties to such suit; and the said bill or petition shall not thereafter be dismissed as to any such lien claimant, or as to the owner or owners of the premises without the consent of such lien claimant. The complainant or petitioner, and all defendants to such bill or petition may contest each other's right without any formal issue of record made up between them other than that (shown) upon the original bill or petition, as well with respect to the amount due as to the right to the benefit of the lien claimed: Provided, that if by such contest by co-defendants any lien claimants be taken by surprise, the court may, in its discretion, as to such claim grant a continuance. The court may render judgment against any party summoned and failing to appear, as in other cases of default. Such suit shall be commenced or answer filed within two years after the completion of the contract, or completion of the extra or additional work, or furnishing of extra or additional material thereunder.

Section 10. Personal Representatives—Death of Parties in Interest.) Suits may be instituted under the provisions of this Act in favor of administrators or executors, and may be maintained against the representatives in the interest of those against whom the cause of action accrued, and in suits instituted under the provisions of this Act, the representatives of any party who may die pending the suit shall be made parties.

Section 11. Who Are Parties in Interest—How and When Made—Or May Become Parties to Suit—Publication, Service of Process on Non-Resident—Claims Not Due, Etc.—Pleading, Requisites of Bill or Petition—Diligence Required in Prosecuting Claim—When and How Party Bringing Suit May Dismiss Same.) The bill or petition shall contain a brief statement of the contract or contracts on which it is founded, the dates when made and when completed, if not completed, why, and it shall also set forth the amount due and unpaid, a description of the premises which are subject to the lien, and such other facts as may be necessary to a full understanding of the rights of the parties. Where plans and specifications are by reference made a part of the contract, it shall not be necessary to set the same out in the pleadings or as exhibits, but the same may be produced on the trial of the suit. The complainant or petitioner shall make all parties interested, of whose interest he is notified or has knowledge, parties defendant, and summons shall issue and service thereof be had as in suits in chancery; and when any defendant resides or has gone out of the State, or on inquiry cannot be found, or is concealed within the State, so that process cannot be served on him, the complainant or petitioner shall cause a notice to be given to him in like manner and upon the same conditions as is provided in suits in chancery, and his failure to so act with regard to summons or notice shall be ground for judgment or decree against him as upon the merits. The same rule shall prevail with cross-petitioners with regard to any person of whose interest they have knowledge, and who are not already parties to the suit or action. Parties in interest, within the meaning of this Act, shall include persons entitled to liens thereunder, whose claims are not, as well as are, due at the time of the commencement of suit, and such claim shall be allowed subject to a reduction of interest from the date of judgment to the time the claim is due; also all persons who may have any legal or equitable claim to the whole or any part of the premises upon which a lien may be attempted to be enforced under the

provisions thereof, or who are interested in the subject matter of the suit. Any such persons may, on application to the court wherein the suit is pending, be made or become parties at any time before final judgment. No action or suit under the provisions of this Act shall be voluntarily dismissed by the parties bringing the same without due notice to all parties before the court and leave of court upon good cause shown and upon terms named by the court.

Section 12. Practice—Powers of Courts—When Receivers May be Appointed.) The court shall permit amendments to any part of the pleadings, and may issue process, make all orders requiring parties to appear, and requiring notice to be given, that are or may be authorized in proceedings in chancery, and shall have the same power and jurisdiction of the parties and subject matter, and the rules of practice and proceedings in such cases shall be the same as in other cases in chancery, except as is otherwise provided in this Act. The court shall have power to appoint receivers for property on which liens are sought to be enforced in the same manner, for the same causes and for the same purposes, as in cases of foreclosure of mortgages, as well as to complete any unfinished building where the same is deemed to be to the best interest of all the parties interested.

Section 13. Practice—Answer—Defense—Right to Recover on Counter Claim.) Defendant shall answer the bill or petition under oath, unless the oath is waived by the claimant or petitioner. The owner shall be entitled to make any defense against the contractor by way of set-off, recoupment or counter claim that he could in any action at law, and shall be entitled to the same right of recovery on proof of such in excess of the claim of the contractor against the contractor only, but for matters not growing out of the contract such recovery shall be made without prejudice to the rights of the subcontractors thereunder for payment of the contract price or fund; and in event that the court shall find, in any proceeding in chancery, that no right to a lien exists, the contractor shall be entitled to recover against the owner as at law, and the court shall render judgment as at law for the amount which the contractor is entitled to, together with costs, in the discretion of the court. In any proceedings to enforce a lien, it shall only be necessary for all persons seeking a lien on account of wages due for labor to file in such proceedings an affidavit, giving the amount due, between what dates the same was performed and the kind of labor performed, and the court shall direct the amount due for wages as therein specified to be paid within a short day to be fixed by the court, unless within ten days after the filing of said claim for wages the amount claimed is contested by the owner or some other party to the suit, and in order to contest the amount due for wages it shall be necessary for the party making such contest to file an affidavit in which he shall state the defense he has to the allowance of such claim, and the court shall proceed at once to hear such evidence as the parties may adduce, and determine the merits as to the allowance of such claim for wages, and in the event that the allowance for wages is not paid within the time fixed by the court, then the court shall order the premises sold to pay such amount, in such manner as the court shall direct.

Section 14. Trials—Parties Ready Not to be Delayed—When Court May Delay Order for Sale or Distribution.) In no case shall the want of preparation for trial of one claim delay the trial in respect to others, but trial shall be had upon issues between such parties as are prepared, without reference to issues between other parties; and when one creditor shall have obtained a decree or judgment for the amount due, the court may order a sale of the premises on which the lien operates, or a part thereof, so as to satisfy the decree or judgment:



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Provided, that the court may, for good cause shown, delay making any order for sale or distribution until the rights of all the parties in interest are ascertained and settled by the court.

Section 15. Preference to Laborers—No Preference to First Contractors.) Upon all questions arising between different contractors having lien under this Act, no preference shall be given to him whose contract was made first, except the claim of any person for wages by him personally performed shall be a preferred lien.

Section 16. Incumbrances—Apportionment—On Improvements Made After Record of Incumbrance—Lien Holders Have Pro Rata Benefit in What Owner Pays For—Fraudulent Incumbrances—Disposition of.) No incumbrance upon land, created before or after the making of the contract under the provisions of this Act, shall operate upon the building erected, or materials furnished, until a lien in favor of the persons having done work or furnished material shall have been satisfied, and upon questions arising between incumbrances and lien creditors, all previous incumbrances shall be preferred to the extent of the value of the land at the time of making of the contract, and the lien creditor shall be preferred to the value of the improvements erected on said premises, and the court shall ascertain by jury or otherwise, as the case may require, what proportion of the proceeds of any sale shall be paid the several parties in interest. All incumbrances, whether by mortgage, judgment or otherwise, charged and shown to be fraudulent, in respect to creditors, may be set aside by the court, and the premises freed and discharged from such fraudulent incumbrance.

Section 17. Costs—How Taxed—Attorneys' Fees.) The costs of proceedings, as between all parties to the suit, shall be taxed equitably against the losing parties, and where taxed against more than one party shall be so taxed against all in favor of the proper party, but equitably as between themselves; and the costs, as between creditors aforesaid in contests relative to each other's claims, shall be subject to the order of the court, and the same rule shall prevail in respect to costs growing out of the proceedings against and between incumbrances. In all cases where liens are enforced, the court shall, in its discretion, order a reasonable attorney's fee taxed as a part of the costs in favor of the lien creditor.

Section 18. What Estate to be Sold—Manner of Making Sales, When Part May be Sold.) Whatever right or estate such owner had in the land at the time of making the contract may be sold in the same manner as other sales of real estate are made under decrees in chancery. If any part of the premises can be separated from the residue, and sold without damage to the whole, and if the value thereof is sufficient to satisfy all the claims proved in the cause, the court may order a sale of that part.

Section 19. Proceeds of Sale—Application of Pro Rata—Labor Claims Preferred—Deficiency Decrees—Excess, to Whom Paid.) The court shall ascertain the amount due each lien creditor, and shall direct the application of the proceeds of sale to be made to each in proportion to their several amounts, according to the provisions of this Act, but the claims of all persons for labor, as provided in Section fifteen (15) shall first be paid. If, upon making sale under this Act, of any or all premises, the proceeds of such sale shall not be sufficient to pay all claims of all parties, according to their rights, the decree shall be credited by the amount of said sale, and execution may issue in favor of any creditor whose claims are not satisfied for the balance due as upon a deficiency decree in the foreclosure of a mortgage in chancery, and such deficiency decree shall be a lien upon all real estate and other property of the party against whom it is entered to the same extent and under the same limitations as a judgment at

law; and in cases of excess of sales over the amount of the decree, such excess be paid to the owner of the land, or to the person who may be entitled to the same, under the direction of the court.

Section 20. Redemption.) Upon all sales under this Act, the right of redemption shall exist in favor of the same persons, and may be made in the same manner as is or may be provided for redemption of real estate from sales under judgments and executions at law.

Section 21. Sub-Contractors — Liens of Sub-Contractors—Who Are—Extent of Their Liens Superior to Creditors or Contractors on Money Due Contractors—Duty of Owner and Contractor to File Notice of Waiver of Lien—Limit of Owner's Liability—Owner Liable for Sub-Contracts Performed After Notice Thereof—Rights of in Case Contractor Default May Complete, If Contractor Abandons.) Every mechanic, workman or other person who shall furnish any materials, apparatus, machinery or fixtures, or furnish or perform services or labor for the contractor, or shall furnish any material to be employed in the process of construction as a means for assisting in the erection of the building or improvement in what is commonly termed form or form work where concrete, cement or like material is used in whole or in part, shall be known under this Act as a sub-contractor, and shall have a lien for the value thereof, with interest on such amount from the date the same is due, from the same time, on the same property as provided for the contractor, and, also, as against the creditors and assignees, and personal and legal representatives of the contractor, on the material, fixtures, apparatus or machinery furnished, and on the moneys or other considerations due or to become due from the owner under the original contract. If the legal effect of any contract between the owner and contractor is that no lien or claim may be filed or maintained by any one, such provision shall be binding; but the only admissible evidence thereof as against a sub-contractor or material man, shall be proof of actual notice thereof to him before any labor or material is furnished by him; or proof that a duly written and signed stipulation or agreement to that effect has been filed in the office of the recorder of deeds of the county or counties where the house, building or other improvement is situated, prior to the commencement of the work upon such house, building or other improvement, or within ten days after the execution of the principal contract or not less than ten days prior to the contract of the sub-contractor or material man. And the recorder of deeds shall record the same at length in the order of time of its reception in books provided by him for that purpose, and the recorder of deeds shall index the same, in the name of the contractor and in the name of the owner, in books kept for that purpose, and also in the tract or abstract book of the tract, lot, or parcel of land, upon which said house, building or other improvement is located, and said recorder of deeds shall receive therefor a fee, such as is provided for the recording of instruments in his office.

In no case, except as hereinafter provided, shall the owner be compelled to pay a greater sum for or on account of the completion of such house, building or other improvement than the price or sum stipulated in said original contract or agreement, unless payment be made to the contractor or to his order, in violation of the rights and interests of the persons intended to be benefited by this Act: Provided, if it shall appear to the court that the owner and contractor fraudulently, and for the purpose of defrauding sub-contractors fixed an unreasonably low price in their original contract for the erection or repairing of such house, building or other improvement, then the



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court shall ascertain how much of a difference exists between a fair price for labor and material used in said house, building or other improvement, and the sum named in said original contract, and said difference shall be considered a part of the contract and be subject to a lien. But where the contractor's statement, made as provided in Section five (5), shows the amount to be paid to the sub-contractor, or party furnishing material, or the sub-contractor's statement, made pursuant to Section twenty-two (22), shows the amount to become due for material; or notice is given to the owner, as provided in Sections twenty-four (24) and twenty-five (25), and thereafter such sub-contract shall be performed, or material to the value of the amount named in such statements or notice, shall be prepared for use and delivery, or delivered without written protest on the part of the owner previous to such performance or delivery, or preparation for delivery, then, and in any of such cases, such sub-contractor or party furnishing or preparing material, regardless of the price named in the original contracts, shall have a lien therefor to the extent of the amount named in such statements or notice. Also, in case of default or abandonment by the contractor, the sub-contractor or party furnishing material, shall have and may enforce his lien to the same extent and in the same manner that the contractor may under conditions that arise as provided for in Section four (4) of this Act, and shall have and may exercise the same rights as are therein provided for the contractor. (As amended by Act approved June 16, 1913, in force July 1, 1913.)

Section 22. Where Partners Taken in After Contract—Lien for Material Furnished to Sub-Contractor—Lien of Sub-Contractor—Statement of Sub-Contractor to Owner or Contractor—Penalty for Failure to Give Statement.) Whenever, after a contract has been made, the contractor shall associate one or more persons as partners or joint contractors, in carrying out the same, or any part thereof, the lien for materials or labor furnished by a sub-contractor to such contractor and his partners or associates, as originally agreed upon, shall continue the same as if the sub-contract had been made with all of said partners. When the contractor shall sub-let his contract, or a specified portion thereof, to a sub-contractor, the party furnishing material to or performing labor for such sub-contractor shall have a lien therefor and may enforce his lien in the same manner as is herein provided for the enforcement of liens by sub-contractors. Any sub-contractor shall, as often as requested in writing by the owner or contractor, or the agent of either, make out and give to such owner, contractor or agent, a statement of the persons furnishing material and labor, giving their names and how much, if anything, is due or to become due to each of them, and which statement shall be made under oath if required. If any sub-contractor shall fail to furnish such statement within five (5) days after such demand, he shall forfeit to such owner or contractor the sum of fifty (\$50) dollars for every offense, which may be recovered in an action of debt before a justice of the peace, and shall have no right of action against either owner or contractor until he shall furnish such statement, and the lien of such sub-contractor shall be subject to the liens of all other creditors.

Section 23. Lien Against Fund Due or to Become Due—Contractors for Public Improvements, Notice—Duty and Liability of Official Notified.) Any person who shall furnish material, apparatus, fixtures, machinery or labor to any contractor having a contract for public improvement for any county, township, school district, city or municipality in this State, shall have a lien on the money, bonds or warrants due or to become due such contractor under such contract: Provided such person shall, before payment or delivery thereof is made to such contrac-

tor, notify the official or officials of the county, township, school district, city or municipality whose duty it is to pay such contractor of his claim by a written notice; and, provided further, that such lien shall attach only to that portion of such money, bonds or warrants against which no voucher or other evidence of indebtedness has been issued and delivered to the contractor by or on behalf of the county, township, school district, city or municipality, as the case may be, at the time of such notice. It shall be the duty of any such official so notified to withhold a sufficient amount to pay such claim until the same is admitted by the contractor, or adjusted by the agreement of the parties, or there has been an adjudication of the same in a court of competent jurisdiction, and thereupon to pay the amount so determined to be due such claimant, if any, and to that end the said county, township, school district, city or municipality, or any of the other parties interested may institute suit in the same manner as is provided herein in case of privately owned real estate to determine the rights of the parties when such claim is filed.

Any person who shall furnish material, apparatus, fixtures, machinery or labor to any contractor having a contract for public improvement for the State, may have a lien on the money, bonds or warrants due or about to become due such contractor under the contract, by filing with the official whose duty it is to pay such contractor a sworn statement of the claim showing with particularity the several items and the amount claimed to be due on each; but the lien shall attach to only that portion of the money, bonds or warrants against which no voucher or other evidence of indebtedness has been issued and delivered to the contractor by or on behalf of the State.

The person so claiming a lien shall, within thirty (30) days after filing notice with the State official, commence proceedings by bill in equity for an accounting, making the contractor to whom such material, apparatus, fixtures, machinery or labor was furnished, party defendant, and shall, within the same period notify the official of the State of the commencement of such suit by delivering to him a certified copy of the bill filed: provided, that suit shall be commenced and a copy of the bill served upon the State official not less than fifteen (15) days before the date when the appropriation from which such money is to be paid, will lapse. It shall be the duty of the State official after the sworn statement has been filed with him, to withhold payment of a sum sufficient to pay the amount of such claim, for the period limited for the filing of suit, unless otherwise notified by the person claiming the lien.

Upon the expiration of this period the money, bonds or warrants so withheld shall be released for payment to the contractor unless the person claiming the lien shall have instituted proceedings and served the official of the State with the certified copy of the bill as herein provided, in which case, the amount claimed shall be withheld until the final adjudication of the suit is had: Provided, the State official may pay over to the clerk of the court in which such suit is pending, a sum sufficient to pay the amount claimed to abide the result of such suit and be distributed by the clerk according to the decree rendered.

Any payment so made to such claimant or to the clerk of the court shall be a credit on the contract price to be paid to such contractor. Any officer violating the duty hereby imposed upon him shall be liable on his official bond to the claimant serving such notice for the damages resulting from such violation, which may be recovered in an action at law in any court of competent jurisdiction. There shall be no preference between the persons serving such notice, but all shall be paid pro rata in proportion to the amount due under their respective contracts. (As amended by Act approved June 28, 1919.)

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Section 24. Notice to the Owner by Sub-Contractor—Limitation for Service of—May be Served on Owner, Agent, Architect or Superintendent in Charge—Duties and Liabilities of Agents, Architect and Superintendent Notified—Excuse of Notice—Sub-Contractors Protected to Amount Named in—Form of.) Sub-contractors, or party furnishing labor or materials, may at any time after making his contract with the contractor, and shall within sixty (60) days after the completion thereof; or, if extra or additional work or material is delivered thereafter, within sixty (60) days after the date of completion of such extra or additional work or final delivery of such extra or additional material, cause a written notice of his claim and the amount due or to become due thereunder, to be personally served on the owner or his agent or architect, or the superintendent having charge of the building or improvement: Provided, such notice shall not be necessary, when the sworn statement of the contractor or sub-contractor provided for herein shall serve to give the owner notice of the amount due and to whom due, but where such statement is incorrect as to the amount, the sub-contractor or material man named shall be protected to the extent of the amount named herein as due or to become due to him.

The form of such notice may be as follows: To (name of owner): You are hereby notified that I have been employed by (name of contractor) to (state here what was the contract or what was done, or to be done, or what the claim is for) under his contract with you, on your property at (here given substantial description of the property) and that there was due to me, or is to become due (as the case may be) thereof, the sum of dollars.

Dated at this day of A. D.

Signature.....

Section 25. Notice to Non-Resident Owner by Filing Claim with Circuit Court, What Claim Shall Consist of—When Itemized Account Not Necessary.) In all cases where the owner, agent, architect or superintendent cannot, upon reasonable diligence, be found in the county in which said improvement is made, or shall not reside therein, the sub-contractor or person furnishing materials, fixtures, apparatus, machinery, labor or services may give notice by filing in the office of the clerk of the Circuit Court against the person making the contract and the owner a claim for lien verified by the affidavit of himself, agent or employee, which shall consist of a brief statement of his contract or demand, and the balance due after allowing all credits, and a sufficient correct description of the lot, lots or tract of land to identify the same. An itemized account shall not be necessary.

Section 26. Lien of Laborers Preferred—Limitation as to Laborer's Notice.) The claim of any person for wages as a laborer under Sections fifteen, twenty-one and twenty-two of this Act shall be a preferred lien.

Section 27. Owner's Duty to Retain and Pay Money After Notice—Preference to Laborers—Manner in Which He Shall Make Payment—Liability of Owners.) When the owner or his agent is notified as provided in this Act, he shall retain from any money due or to become due the contractor, an amount sufficient to pay all demands that are or will become due such sub-contractor, tradesman, materialmen, mechanic or workmen of which claim he is notified, and shall pay over the same to the parties entitled thereto.

Such payments shall be as follows:

First—All claims for wages shall be paid in full.

Second—The claims of tradesmen, materialmen and sub-contractors, who are entitled to liens, pro rata, in proportion to the amount due them respectively. All payments made as directed shall, as between such owner and contractor, be considered the same as if paid to such contractor. Any

payment made by the owner to the contractor after such notice, without retaining sufficient money to pay such claims, shall be considered illegal and made in violation of the rights of the laborers and sub-contractors, and the rights of such laborers and sub-contractors to a lien shall not be affected thereby, but the owner shall not be held liable to any laborer and sub-contractor or other person whose name is omitted from the statement provided for in Sections five (5) and twenty-two (22) of this Act, nor for any larger amount than the sum therein named as due such person (provided such omission is not made with the knowledge or collusion of the owner), unless previous thereto or to his payment to his contractor, he shall be notified, as herein provided, by such person of their claim and the true amount thereof.

Third—The balance, if any, to the contractor.

Section 28. Suits to Enforce Lien by Sub-Contractors—When Can be Brought, Pleadings, Action at Law Against Owner and Contractor—Proceedings, Extent of Owner's Liability.) If any money due to the laborers or sub-contractor be not paid within ten (10) days after his notice is served, as provided in Sections five (5), twenty-four (24), twenty-five (25) and twenty-seven (27), then such person may either file his petition and enforce his lien as hereinbefore provided for the contractor in Sections nine (9) to twenty (20), inclusive, of this Act, except as to the time within which suit shall be brought, or he may sue the owner and contractor jointly for the amount due him in any court having jurisdiction of the amount claimed to be due, and a personal judgment may be rendered therein, as in other cases. In such actions at law, as in suits to enforce the lien, the owner shall be liable to the plaintiff for no more than the pro rata share that such person would be entitled to with other sub-contractors out of the funds due to the contractor from the owner under the contract between them, except as hereinbefore provided for laborers, and such action at law shall be maintained against the owner only in case the plaintiff establishes his right to the lien. All suits and actions by sub-contractors shall be against both contractor and owner jointly, and no decree or judgment shall be rendered therein until both are duly brought before the court by process of publication, and in all courts, including actions before a justice of the peace and police magistrate, such process may be served and publication made as to all persons except the owners, as in suits in chancery. All such judgments, where the lien is established, shall be against both jointly, but shall be enforced against the owner only to the extent that he is liable under his contract as by this Act provided, and shall recite the date from which the lien thereof attached according to the provisions of Sections one (1) to twenty (20) of this Act, but this shall not preclude a judgment against the contractor personally, where the lien is defeated.

Section 29. Judgment Before Justice of the Peace—When Transcript of May be Filed—Execution Thereon—Liens Thereof.) If the execution issued on a judgment obtained before a justice of the peace or police magistrate shall be returned not satisfied, a transcript of such judgment may be taken to the Circuit Court and spread upon the records thereof, and execution issued thereon as in other cases except that the lien of the same shall be preserved as a preferred lien on the property improved from the date recited in the judgment, and enforced thereon the same as if a decree had been rendered by the Circuit Court in a suit to enforce such lien under the provisions of this Act.

Section 30. Proceedings for General Settlement—Interpleader—How Liens and Claims Cut Off and Judgments Thereon Stayed in Such Proceedings.) If there are several liens under Sections twenty-one (21) and twenty-two (22) upon the same prem-

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ises, and the owner or any person having such a lien shall fear that there is not a sufficient amount coming to the contractor to pay all such liens, such owner or any one or more persons having such lien may file his or their bill or petition in the Circuit Court of the proper county, stating such fact and such other facts as may be sufficient to a full understanding of the rights of the parties. The contractor and all persons having liens upon or who are interested in the premises, so far as the same are known to or can be ascertained by the claimant or petitioner upon diligent inquiry, shall be made parties. Upon the hearing the court shall find the amount coming from the owner to the contractor, and the amount due to each of the persons having liens, and in case the amount found to be coming to the contractor shall be insufficient to discharge all the liens in full, the amount so found in favor of the contractor shall be divided between the persons entitled to such liens pro rata after the payments of all claims for wages in proportion to the amount so found to be due them respectively. If the amount so found to be coming to the contractor shall be sufficient to pay the liens in full, the same shall be so ordered. The premises may be sold as in other cases under this Act. The parties to such suit shall prosecute the same under the requirements as are directed in Section eleven (11) of this Act, and all persons who shall be duly notified of such proceedings and who shall fail to prove their claims, whether the same be in judgment against the owner or not, shall forever lose the benefit of and be precluded from their liens and all claims against the owner. Upon the filing of such bill or petition the court may, on the motion of any person interested, and shall, upon final decree, stay further proceedings upon any suit against the owner on account of such liens, and costs in such cases shall be adjusted as provided for in Section seventeen (17).

Section 31. Failure to Complete Contract by Contractor—Requisites and Manner of Sub-Contractor's Suit in Case of Owner's Liability in Case of.) Should the contractor, for any cause, fail to complete his contract, any person entitled to a lien as aforesaid may file his petition in any court of record against the owner and contractor, setting forth the nature of his claim, the amount due, as near as may be, and the names of the parties employed on such house or other improvements subject to liens; and a notice of such suit shall be served on the persons therein named, and such as shall appear shall have their claim adjudicated. The premises may be sold as in other cases under this Act. The parties to such suit shall prosecute the same under like requirements as are directed in Section eleven (11) of this Act.

Section 32. Payment of Owner to Contractor—When Wrongful.) No payments to the contractor or to his order of any money or other considerations due or to become due to the contractor shall be regarded as rightfully made, as against the sub-contractor, laborer or party furnishing labor or materials, if made by the owner without exercising and enforcing the rights and powers conferred upon him in Sections five (5) and twenty-two (22) of this Act.

Section 33. Limitation as to Suit of Sub-Contractors to Enforce Lien.) Petition shall be filed or suit commenced to enforce the lien created by Sections twenty-one (21) and twenty-two (22) of this Act within four months after the time of the final payment is due the sub-contractor, laborer or party furnishing material.

Section 34. General Provisions—Suit to be Commenced or Answer Filed by Lien Claimants, and Within Thirty (30) Days on Demand of Owner, Lienor or Interested Party.) Upon written demand of the owner, lienor or any person interested in the real estate, or their agent or attorney, served on the person claiming the lien, or his agent or attorney, requiring suit to be commenced to

enforce the lien, or answer to be filed in a pending suit, suit shall be commenced, or answer filed within thirty days thereafter, or the lien shall be commenced or answer filed within thirty days thereafter, or the lien forfeited, and same released if a claim for a lien has been filed with the clerk of the Circuit Court.

Section 35. Neglect to Satisfy Lien Paid or to Release Where Not Sued on Time—Penalty.) Whenever a claim for lien has been filed with the clerk of the Circuit Court, either by the contractor or sub-contractor, and is afterward paid with cost of filing same, or where there is a failure to institute suit to enforce the same after demand, as provided in the preceding section, within the time by this Act limited, the person filing the same or someone by him duly authorized in writing so to do shall acknowledge satisfaction or release thereof, in the proper book in such office, in writing on written demand of the owner, and on neglect to do so for ten days after such written demand, he shall forfeit to the owner the sum of twenty-five (25) dollars, which may be recovered in an action of debt before a justice of the peace.

Section 36. Penalty for Wrongful Sale, Use or Removal of Materials.) Any owner, contractor, sub-contractor or other person who shall purchase material on credit and represent at the time of purchase that the same are to be used in a designated building or buildings, or other improvement, and shall thereafter sell, use or cause to be used, the said materials in the construction of, or remove the same to any building or improvement other than that designated or dispose of the same for any purpose, without the written consent of the person of whom the materials were purchased, with intent to defraud such person, shall be deemed guilty of a misdemeanor and, on conviction, shall be punished by a fine not exceeding five hundred dollars (\$500), or confined in the county jail not exceeding one year, or both so fined and imprisoned.

Section 37. Liens Against Boats, Barges and Water Craft.) Any architect, contractor, sub-contractor, materialman or other person furnishing services, labor or material for the purpose of or in constructing, building, altering, repairing or ornamenting a boat, barge or other water craft, shall have a lien on such boat, barge or other water craft for the value of such services, labor or material in the same manner as in this Act provided for services, labor or material furnished by such parties for the purpose of building, altering, repairing or ornamenting a house or other building. And such lien may be established and enforced in the same manner as liens are established and enforced under this Act, and the parties shall be held to the same obligations, duties and liabilities as in case of a contract for building, altering, repairing or ornamenting a house or other building.

Section 38. Circuit Court Clerk's Duties with Regard to Claims Filed—Abstract Fee.) When claims for liens are filed pursuant to the provisions of Sections seven (7) and twenty-five (25), the clerk of the Circuit Court shall endorse thereon the date of filing, and make an abstract thereof, in a book kept for that purpose and properly indexed, containing the name of the person filing the lien, the amount of the lien, the date of filing, the name of the person against whom the lien is filed, and a description of the property charged with the lien, for which the person filing the lien shall pay one dollar (\$1.00) to the Clerk.

Section 39. This Act is and shall be liberally construed as a remedial Act.

Section 40. An Act entitled, "An Act to revise the law in relation to mechanic's liens," approved and in force June 26, 1895, and all other Acts and parts of Acts inconsistent with this Act are hereby repealed: Provided, that this section shall not be construed as to affect any rights existing or actions pending at the time this Act shall take effect.

Hurd's Rev. St. 1916, p. 1655, chap. 82 sec. 15.



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NATION - WIDE FACILITIES

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Note: For amendments to "Use" and "Volume" Districts maps, consult Journal of Council Proceedings.	

BUILDING ORDINANCE

OF THE CITY OF CHICAGO

Revised Code of 1922

Comprising Chapter XVII, Sections 396 to 945 of the Chicago Code of 1922.
With Amendments up to and including July 29, 1930.

Attention is directed to the numerous Special Rulings of the Department of Buildings on certain sections in the Building Ordinance and which follow at the end thereof.

Attention is likewise directed to the Chicago Zoning Ordinance which follows immediately after the Special Rulings.

To eliminate obscurity in the meaning of the ordinances, a plan of illustrating the difficult passages by means of illustrative diagrams has been adopted with the approval of the Commissioner of Buildings. All diagrams used, have been submitted to the commissioner to determine their correctness of interpretation and are published with his sanction.

The illustrative drawings and diagrams with their description and arrangement are copyrighted and the system protected and all rights are reserved in this as well as other cities of the United States.

The Building Ordinance of the City of Chicago is now in process of revision. We are advised by those in charge that it may require some time to complete the work.

In the event that the revised Building Ordinance is completed before the anticipated time, a supplement containing same will be sent to the users of the "Handbook for Architects and Builders."

Following the Building Ordinance will be found an ordinance governing structures or space for housing motor vehicles belonging to occupants of fireproof apartment hotels and apartment buildings (passed June 20, 1928), and an ordinance governing the installation of Warm Air Heating Plants.

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CHAPTER XVII.

Buildings.

ARTICLE I.

396. Department of Buildings Established—Officers.) There is hereby established an executive department of the municipal government of the City of Chicago which shall be known as the Department of Buildings and which shall embrace a Commissioner of Buildings, a Deputy Commissioner of Buildings, a Building Inspector in charge, an Elevator Inspector in charge, a Secretary of the Department of Buildings and such number of assistant Building Inspectors in charge, Building Inspectors, Elevator Inspectors, and such other officers, assistants and employees as may be from time to time provided for in the annual appropriation ordinance.

397. Building Commissioner—Appointment Bond.) There is hereby created the office of Commissioner of Buildings. He shall be the head of said department of buildings and shall be an experienced architect, or a civil, structural or architectural engineer or a building contractor or an efficient building mechanic and shall have been engaged as an architect or a civil, structural or architectural engineer or building contractor or building mechanic for a period of not less than ten years prior to his appointment. During his term of office as Commissioner of Buildings he shall not be engaged in any other business.

He shall be appointed by the Mayor, by and with the advice and consent of the City Council.

The Commissioner of Buildings before entering upon the duties of his office shall execute a bond to the city in the sum of twenty-five thousand dollars, with such sureties as the City Council shall approve, conditioned for the faithful performance of his duties as the Commissioner of Buildings.

398. Other Offices.) There are hereby created the offices of Deputy Commissioner of Buildings, Engineer in Charge, Building Inspector in charge, Elevator Inspector in charge, Fire Escape Inspector in charge, Secretary to the Commissioner of Buildings,

Assistant Engineer in charge and the officers of such number of Assistant Building Inspectors in charge, Building Inspectors, Elevator Inspectors and Fire Escape Inspectors as may from time to time be provided for in the annual appropriation ordinance. The incumbents of these offices shall be known and designated by their respective titles as herein set forth.

399. Appointment of Subordinates—Duties of Commissioner.) (a) The Commissioner of Buildings shall have the management and control of all matters and things pertaining to the department of buildings, and shall appoint, and may remove according to law, all subordinate officers and assistants in his department. All subordinate officers, assistants, clerks and employes in said department shall be subject to such rules and regulations as shall be prescribed from time to time by said Commissioner.

(b) The Commissioner of Buildings shall institute such measures and prescribe such rules and regulations for the control and guidance of his subordinate officers and employes as shall secure the careful inspection of all buildings while in process of construction, alteration, repair or removal and the strict enforcement of the several provisions of this chapter.

(c) It shall be the duty of said commissioner and his assistants to enforce all ordinances relating to the erection, construction, alteration, repair, removal or the safety of buildings.

400. Personal Liability.) In all cases where any action is taken by the Commissioner of Buildings to enforce the provisions of any of the sections contained in this chapter or to enforce the provisions of any of the building ordinances of the city now or at any time hereafter in force, whether such action is taken in pursuance of the express provisions of such sections or ordinances or in a case where discretionary power is given by the ordinances of said city to the Commissioner of Buildings, such acts shall be done in the name of and on behalf of the City of Chicago, and the said Commissioner of Buildings in so acting for the city shall not render himself liable personally, and he is hereby relieved from

all personal liability, for any damage that may accrue to persons or property as a result of any such act permitted in good faith in the discharge of his duties, and any suit brought against the said Commissioner of Buildings by reason thereof shall be defended by the Department of Law of said city until the final termination of the proceedings therein.

401. Power to Pass On Ordinances.) The Commissioner of Buildings shall have full power to pass upon any question arising under the provisions of this chapter, subject to the conditions, modifications and limitations contained therein.

402. Inspection of Buildings or Structures Where Complaint is Made—Duty of Commissioner—Unlawful to Continue Use of Buildings Not in Compliance with Ordinances.) It shall be the duty of the Commissioner of Buildings where any citizen represents that any building or structure or part thereof is in an unsafe or dangerous condition, or that the stairways, corridors, exits or fire escapes in any factory or workshop or other place of employment are insufficient for the escape of employees in case of fire, panic or accident, or that the stairways, exits and fire escapes of any building or structure in the city do not comply with the requirements of this chapter to make an examination of such building or structure, and if such representation is found to be true the said Commissioner shall give notice in writing to the owner, occupant, lessee or person in possession, charge or control of such building or structure to make such changes, alterations or repairs as safety or the ordinances of the city may require. Upon failure of parties so notified to comply with the requirements of said notice the matter shall be placed in the Department of Law of the City of Chicago for prosecution.

It shall be unlawful to continue the use of such buildings until the changes, alterations or repairs found necessary by the Commissioner of Buildings to make such building or part thereof safe or to bring it into compliance with this Chapter, shall have been made.

403. Buildings Found in Unsafe Condition—Notice to Owner—Authority of Commissioner.) (a) Whenever the Commissioner of Buildings shall find any building, or structure or part thereof in the city in such an unsafe condition as to endanger life, but in such condition that by the immediate application of precautionary measures such danger may be averted, he shall have authority, and it shall be his duty, to forthwith notify, in writing, the owner, agent or person in possession, charge or control of such building or structure or part thereof, to adopt and put into effect such precautionary measures as may be necessary or advisable in order to place such building or structure or part thereof in a safe condition; such notice shall state briefly the nature of the work required to be done and shall specify the time within which the work required to be done shall be completed by the person, firm or corporation notified, which shall be fixed by said Commissioner of Buildings, upon taking into consideration the condition of such building or structure or part thereof, and the danger to life or property which may result from its unsafe condition.

(b) Whenever such Commissioner of Buildings shall be unable to find the owner of such building, structure or part thereof, or any agent or person in possession, charge or control thereof, upon whom such notice may be served, he shall address, stamp and mail such notice to such person or persons at their last known address, and in addition thereto shall place or cause to be placed the notice herein provided for upon such building at or near its principal entrance, and shall also post or cause to be posted in

a conspicuous place at each entrance to such building, in large letters, a notice as follows:

"THIS BUILDING IS IN A DANGEROUS CONDITION AND HAS BEEN CONDEMNED BY THE COMMISSIONER OF BUILDINGS."

(c) It shall be unlawful for any person, firm or corporation to remove said notice or notices without written permission from the Commissioner of Buildings.

(d) If at the expiration of the time specified in such notice for the completion of the work required to be done by the terms of such notice, in order to render the building or structure safe, said notice shall not have been complied with, and said building or structure is in such an unsafe condition as to endanger life or property, it shall be the duty of the Commissioner of Buildings to proceed forthwith to tear down or destroy that part of said building or structure that is in such unsafe condition as to endanger life or property, and in cases where an unsafe building or structure cannot be repaired or rendered safe by the application of precautionary measures, such building or structure, or the dangerous parts thereof, shall be torn down by said Commissioner of Buildings or by his order and the expense of tearing down any part of such building or structure shall be charged to the person owning or in possession, charge or control of such building or structure or part thereof, and the said commissioner shall recover or cause to be recovered from such owner or person in possession, charge or control thereof the cost of doing such work, by legal proceedings prosecuted by the Law Department.

(e) If the owner, agent or person in possession, charge or control of such building or structure, or part thereof, when so notified, shall fail, neglect or refuse to place such building or structure, or part thereof, in a safe condition, and to adopt such precautionary measures as shall have been specified by said commissioner within the time specified in such notice, in such case, at the expiration of such time it shall be unlawful for any person, firm or corporation to occupy or use said building or structure, or any part thereof, until said building or structure or part thereof is placed in a safe condition; and in case where a building or structure, or part thereof, is in a dangerous or unsafe condition and has not been placed in a safe condition within the time specified in the notice of the Commissioner of Buildings, such building or structure, or such part thereof, shall be forthwith vacated, and it shall be unlawful for any person or persons to enter same except for the purpose of making repairs required by the Commissioner of Buildings and the ordinances of the City of Chicago.

404. Building or Part of Building Constructed or Being Constructed in Violation of Chapter—Authority of Commissioner to Tear Down.) (a) Whenever it shall be found that any building or structure, or part thereof, is being, or shall have been constructed or built in violation of any of the provisions of this chapter, the Commissioner of Buildings shall forthwith notify the owner, agent, superintendent or architect of, or the contractor engaged in erecting such building or structure, or part thereof, of the fact that such building or structure, or part thereof, has been, or is being, constructed or erected contrary to the provisions of this chapter and shall specify briefly in such notice in what manner the provisions of this chapter or any of them, have been violated, and shall require the person so notified to forthwith make such building, structure, or part thereof, conform to and comply with the provisions of this chapter, specifying in

such notice the time within which such work shall be done.

(b) If, at the expiration of the time set forth in such notice, the person so notified shall have refused, neglected or failed to comply with the request made in such notice and to have such building or structure, or part thereof, concerning which notice was sent, changed so as to conform to and comply with the provisions of this chapter, the Commissioner of Buildings shall have the authority, and it shall be his duty to proceed forthwith to tear down or cause to be torn down such building or structure, or such part thereof as shall or may have been erected and constructed in violation of any of the provisions of this chapter, and the cost of such work shall be charged to and recovered from the owner of such building or structure or from the person for whom such building of structure is being erected, in legal proceedings prosecuted by the Department of Law.

405. May Direct Fire Department to Remove.) The Commissioner of Buildings shall have authority to direct the Fire Commissioner to tear down any defective or dangerous wall or structure or any building or structure or part thereof which may be constructed in violation of the terms of this chapter, after written notice has been served upon the owner, lessee, occupant, agent or person in possession, charge or control, directing him or them to tear down or remove any defective wall, building or structure, or any part thereof, which is in a dangerous condition, which has been, or is being, constructed or maintained in violation of the terms of this chapter. In case of the destruction or partial destruction of buildings by fire, decay or otherwise, when any department of the city government, pursuant to the ordinances of the city, shall make an outlay of money or incur any liability for the payment of any expense on behalf of the city in an effort to preserve or prevent the destruction of such building or buildings, or structure, or for the preservation of life of its citizens, it shall be the duty of the Commissioner of Buildings to ascertain the amount of such outlay or expenditure and present a bill therefor to the owner or owners of any such building or buildings, or its or their agent or agents, and it shall be the duty of said Commissioner of Buildings to refuse to issue a permit for the construction, re-construction, alteration or repair of any building or buildings or structure by any such owner or owners, lessee, occupant, agent or person in possession, charge or control thereof until such outlay or expenditure shall be repaid to the city by the owner, lessee, occupant, agent or person in possession, charge or control of such building or buildings thus totally or partially destroyed in the manner aforesaid. Said commissioner shall also proceed forthwith to collect the amount of such bill from such owner or owners, by legal proceedings prosecuted by the Department of Law.

406. May Stop Construction and Wrecking of Buildings.) (a) Said commissioner shall have power to stop the construction of any building or the making of any alterations or repairs of any building within said city when the same is being done in a reckless or careless manner, or with defective material, or in violation of any ordinance, and to order, in writing or by parol, any and all persons in any way or manner whatever engaged in so constructing, altering or repairing any such building, to stop and desist therefrom.

(b) And the said commissioner shall have power to stop the wrecking or tearing down of any building or structure within said city when the same is being done in a reckless or careless manner or in violation

of any ordinance or in such a manner as to endanger life or property, and to order any and all persons engaged in said work to stop and desist therefrom. When such work has been stopped by the order of said commissioner, it shall not be resumed until said commissioner shall be satisfied that adequate precautions will be taken for the protection of life and property, and that said work will be prosecuted carefully and in conformity with the ordinances of the city.

407. Arbitration—Appeal from Decision.)

(a) In all cases where discretionary power is given to the Commissioner of Buildings to estimate damage to buildings, as also in questions relating to the security of any building or buildings or structures, or part thereof, and in all other cases where discretionary powers are given by ordinance to the Commissioner of Buildings, any party or parties believing themselves injured or wronged by the decision of the Commissioner of Buildings may before instituting any suit, make an appeal for arbitration as follows, to-wit:

(b) Any person wishing to make an appeal shall do so within five days after written notice of the decision or order of the Commissioner of Buildings has been given. An appeal made later than five days after the serving of the notice of the Commissioner of Buildings shall not entitle the appellant to any arbitration. The request for arbitration shall be in writing and shall state the object of the proposed arbitration and the name of the person who is to represent the appellant as arbitrator.

(c) The Commissioner of Buildings shall thereupon inform the appellant of the cost of such arbitration and such appellant shall, within twenty-four hours from the receipt of such information, deposit with the Commissioner of Buildings the sum of money requested for defraying the expense of the same, which sum shall be fixed in each case by said commissioner in proportion to the time it will take and the difficulty and importance of the case, but shall in no case be more than the cost of similar service in the course of ordinary business of private individuals or corporations. As soon as such sum of money shall have been deposited with him, the Commissioner of Buildings shall appoint an arbitrator to represent the city and the two arbitrators thus chosen shall, if they cannot agree, select a third arbitrator, and the decision of any two of these arbitrators shall, after investigation and consideration of the matter in question, be final and binding upon the appellant as well as the city unless an appeal is taken therefrom, as provided in case of an appeal under a statutory arbitration, within five days thereafter.

408. Arbitrators to Take Oath—Power to Examine Witnesses.) The arbitrators shall themselves, before entering upon the discharge of their duties, be placed under oath by the City Clerk, to the effect that they are unprejudiced as to the matter in question and that they will faithfully discharge the duties of their position. They shall have the power to call witnesses and place them under oath, and their decision or award shall be rendered in writing, both to the Commissioner of Buildings and to the appellant. The fee deposited by the appellant with the Commissioner of Buildings shall be paid by the Commissioner of Buildings to the arbitrators upon the rendering of their report and shall be in full of all costs incident to the arbitration; but should the decision of said board of arbitration be rendered against the Commissioner of Buildings, then the money deposited by the aforesaid appellant shall be returned to him and the entire cost of such arbitration shall be paid by the city.

409. In Urgent Cases—Commissioner's Power Final.) Whenever the decision of the Commissioner of Buildings upon the safety of any building or any part thereof is made in a case which is so urgent that failure to properly carry out his orders to demolish or strengthen such building or part thereof may endanger life and limb, the decision and order of the Commissioner of Buildings shall be absolute and final.

410. Duty of Police to Assist Commissioner in Enforcing Provisions of this Chapter.) Whenever it shall be necessary, in the opinion of the Commissioner of Buildings, to call upon the Department of Police for aid or assistance in carrying out or enforcing any of the provisions of this chapter, he shall have the authority so to do, and it shall be the duty of the Department of Police, or of any member of said department, when called upon by said commissioner, to act according to the instructions of, and to perform such duties as may be required by said commissioner in order to enforce or put into effect the provisions of this chapter.

411. Certificates—Notices—Register.) (a) The Commissioner of Buildings shall sign or cause to be signed all certificates and notices required to be issued from the Department of Buildings and shall keep a record of the same, and shall issue or cause to be issued all permits authorized by this chapter.

(b) He shall also keep a proper record of all transactions and operations of the department and such record shall be at all times open to the inspection of the Mayor, Comptroller, Superintendent of Police, Fire Commissioner and members of the City Council.

412. Must Keep Account of Fees Paid—Annual Reports and Estimates.) (a) Said commissioner shall keep in proper books for that purpose an accurate account of all fees charged, giving the name of person to whom same is charged, date on which said charge is made, and the amount of each such fee.

(b) He shall also, annually, on or before the first day of March in each year prepare and present to the City Council a report showing the receipts and expenditures and entire work of the Department of Buildings during the previous fiscal year and he shall on or before November first of each year prepare and submit to the Comptroller an estimate of the whole cost and expense of providing for and maintaining his office during the ensuing fiscal year.

413. Examination and Approval of Plans—Record of Inspections and Complaints.) The Commissioner of Buildings and his assistants shall pass upon all questions relating to the strength and durability of buildings or structures; shall examine and approve all plans before a permit is issued for the construction of any building or structure. The Commissioner of Buildings shall cause to be kept a complete record showing the location and character of every building or other structure for which a permit is issued and shall cause to be filed every report of inspection made on such building, which reports shall bear the signatures of the inspectors making such inspections. He shall cause a record to be kept of all complaints of violations of the building laws and shall cause all such complaints to be investigated.

414. Deputy Commissioner of Buildings—There is hereby created the office of Deputy Commissioner of Buildings. He shall be appointed by the Commissioner of Buildings, according to law. The person certified to fill this office shall be either a civil, structural or architectural engineer or an architect, an experienced building contractor or an efficient building mechanic with at least five years' experience and training.

415. Deputy Commissioner of Buildings—Duties.) (a) The Deputy Commissioner of Buildings shall act as Commissioner of Buildings in the absence of the Commissioner of Buildings from his office and while so acting shall discharge all the duties and possess all the powers imposed upon or vested in the Commissioner of Buildings.

(b) The deputy commissioner of buildings shall, under the direction of the Commissioner of Buildings, have general control of all matters and things pertaining to the work of the Department of Buildings and shall perform such other duties as may be required of him by the Commissioner of Buildings.

416. Engineering Staff.) The Commissioner of Buildings shall appoint according to law at least four Architectural Engineers, and such other engineers and assistants as the City Council may by ordinance provide, for service on the engineering staff of the Department of Buildings. Every person certified to fill the position of Architectural Engineer shall be a civil, structural or architectural engineer of at least five years' training and experience.

417. Architectural Engineers — Duties.) The Architectural Engineers shall, under the direction of the Commissioner of Buildings, examine all plans submitted for the purpose of obtaining a permit. They shall also examine and verify the figures on all floor load placards before such placards are approved for posting. They shall, in addition thereto, perform such other duties as may be required of them by the Commissioner of Buildings.

418. Building Inspector in Charge—Duties.) (a) There is hereby created the office of Building Inspector in charge of the Department of Buildings. He shall be appointed by the Commissioner of Buildings according to law. The person certified to fill this position shall be a civil, structural, architectural or fire protection engineer, or an architect, or building superintendent or a building mechanic, with at least five years' experience in general building construction.

(b) In the absence of the Commissioner of Buildings and the Deputy Commissioner of Buildings from their offices the Building Inspector in Charge shall act as Commissioner of Buildings, and while so acting he shall discharge all of the duties and possess all of the powers imposed upon or vested in the Commissioner of Buildings.

(c) He shall have immediate charge of the periodical inspection of buildings and of the inspection of buildings and structures being erected, enlarged, altered or repaired, excepting only such inspection as is expressly assigned to the elevator or fire-escape inspectors or is by law assigned to some other department of the city government.

419. Assistant Building Inspectors In Charge.) (a) The Commissioner of Buildings shall appoint, according to law, at least four Assistant Building Inspectors in Charge.

(b) Every person certified to fill the position of Assistant Building Inspector in Charge shall be a civil, structural, architectural or fire protection engineer, or an architect, or a building superintendent or a building mechanic with at least five years' experience in general building construction. The Assistant Building Inspectors in Charge shall have immediate charge of the several districts assigned to them by the Commissioner of Buildings and shall perform such other duties as the Commissioner of Buildings shall require them.

420. Building Inspectors.) (a) The Commissioner of Buildings shall appoint according to law such Building Inspectors as may be necessary.

(b) Every person certified to fill the position of Building Inspector shall be a civil, structural, architectural or fire protection engineer, or an architect, or a building superintendent or a building mechanic with at least five years' experience in general building construction. The Building Inspectors shall, under the direction of the Building Inspector in Charge, examine all buildings and structures in the course of erection, enlargement, alteration, repair or removal, as often as is required for efficient supervision, and shall make such periodical examinations of existing structures as shall be assigned to them. They shall examine all buildings, structures and walls reported to be in dangerous condition. They shall examine all buildings and other structures for the enlarging, altering, raising or removing of which, application for permit shall be made.

(c) Every building inspector shall make written reports daily to the Commissioner of Buildings as to the condition in which he found each building examined and as to violations, if any, of the ordinances which the Commissioner of Buildings is required to enforce, together with the street and number of the premises where such violations, if any, were found, the names of the owner, agent, lessee and occupant thereof, and of the architect and the contractor engaged in and about the work in question. The Building Inspectors shall perform such other duties as may be required of them by the Commissioner of Buildings.

421. Elevator Inspector in Charge.) (a) There is hereby created the office of Elevator Inspector in Charge. He shall be appointed by the Commissioner of Buildings according to law.

(b) The person certified to fill the position of Elevator Inspector in Charge, shall be a graduate in engineering from a recognized technical school, shall be versed in the essentials of both mechanical and electrical engineering and shall have had at least five years experience in shop or construction work.

422. Duties of Elevator Inspector in Charge.) The Elevator Inspector in Charge shall examine all plans for the installation of elevators and for the installation of mechanical devices and apparatus in theaters, amusement parks and the like, and, no such elevator, mechanical device or apparatus shall be installed or operated without the approval of the Elevator Inspector in Charge. The Elevator Inspector in Charge shall cause such inspection to be made of all new installations, as may be necessary to insure the carrying out of the approved plans and shall cause such periodic inspection to be made of existing installations of such mechanisms, devices and apparatus, as may be required by the Commissioner of Buildings, and shall perform such other duties as may be required of him by the Commissioner of Buildings.

423. Elevator Inspectors.) (a) The Commissioner of Buildings shall appoint according to law such Elevator Inspectors as may be necessary.

(b) Every person certified to fill the position of Elevator Inspector shall be a mechanical engineer, machinist or elevator builder, and shall be well grounded in the rudiments of mechanical and electrical engineering.

424. Duties of Elevator Inspectors.) The Elevator Inspectors shall inspect all elevators and such other mechanisms, devices and apparatus as shall be assigned to them by the Elevator Inspector in Charge, both existing and in process of being erected or installed, together with all the equipment and enclosures thereof. They shall make written reports daily to the Commissioner of Buildings as to the condition in which

they find the elevators, equipment, enclosures, mechanisms, devices and apparatus, inspected by them, and of any violations of the requirements of this Chapter pertaining to such matters, together with the street and number of the premises where such violations, if any, occur, the names of the owner, agent, lessee and occupant thereof, and of the architect and contractor engaged in or about the construction and installation of such elevators, equipment, enclosures, mechanisms, devices or apparatus. They shall perform such other duties as may be required of them by the Commissioner of Buildings.

425. Secretary—Duties.) (a) There is hereby created the office of Secretary of the Department of Buildings. He shall be appointed by the Commissioner of Buildings according to law.

(b) The Secretary to the Commissioner of Buildings shall, under the supervision and direction of the Commissioner of Buildings, preserve and keep all books, records and papers belonging to the office of the Department of Buildings or which are required by law to be filed therein. He shall perform such other duties as may be required of him by the Commissioner of Buildings.

426. Clerical Assistants.) The Commissioner of Buildings shall appoint according to law, such clerical assistants, stenographers and messengers and other employees as may be provided for by the city council as may be necessary; and they shall perform such duties as may be required of them by the Commissioner of Buildings.

427. Bonds.) The deputy commissioner of buildings, the building inspector in charge, the assistant building inspector in charge, the elevator inspector in charge and the architectural engineers shall, before entering upon the duties of their offices or positions, each execute a bond running to the city of Chicago, conditioned for the faithful performance of their duties, with such sureties as the city council shall approve in the following sums: the deputy commissioner of buildings, ten thousand dollars; the building inspector in charge, the assistant building inspector in charge, the elevator inspector in charge, and the architectural engineers, five thousand dollars each.

428. Employees Not to Engage in Another Business.) Every employee in the Department of Buildings shall devote his entire time to such employment and shall not be engaged in any other business or vocation.

429. Power of Entry.) The Commissioner of Buildings and his Assistants are empowered to enter any building or structure or premises, whether completed or in process of erection, for the purpose of determining whether the same has been or is being constructed and maintained in accordance with the provisions of this chapter and it shall be unlawful to exclude them from any such building, structure or premises.

ARTICLE II.

Permits, Plans and Fees

430. Permits—When Required—Limitations of Time For—Reports of Permits Issued.) Before proceeding with the erection, enlargement, alteration, repair or removal of any building or structure in the city, a permit for such erection, enlargement, alteration, repair or removal shall first be obtained by the owner or his agent from the Commissioner of Buildings, and it shall be unlawful to proceed with the erection, enlargement, alteration, repair or removal of any building or of any structural part thereof within the city unless such permit shall have first been obtained from the Commissioner of Buildings. And if after such permit shall have been granted,

the operations called for by the said permit shall not be begun within six months after the date thereof, or if such operations are not completed within a reasonable time, then such permit shall be void, and no operations thereunder shall be begun or completed until an extended permit shall be taken out by the owner or his agent, and a fee of twenty-five per cent. of the original cost of permit shall be charged for such extended permit, provided, however, that in no case shall a permit be issued or renewed for a less fee than two dollars.

(a) The Commissioner of Buildings shall prepare each day a report of the permits issued on the previous day, giving all the necessary information contained in same, including the legal description when given and the value of building to be constructed or altered, and to file one copy of this report with the Board of Assessors of Cook County, one copy with the Board of Review of Cook County and one copy with the Corporation Counsel of the City of Chicago.

431. Permits—Application For. Application for building permits shall be made by the owner or his agent to the Commissioner of Buildings. When such application is made, plans in conformity with the provisions of this chapter which have been examined and approved by the Commissioner of Buildings and his assistants, as hereinbefore provided for, shall be filed with the Commissioner of Buildings. He shall then issue a permit, and shall file such application, and shall apply to such plans a final official stamp, stating that the drawings to which the same has been applied comply with the terms of this chapter. The plans so stamped shall then be returned to such applicant. True copies of so much of such plans as may be required in the opinion of the Commissioner of Buildings to illustrate the features of construction and equipment of the building referred to, shall be filed with the Commissioner of Buildings, and shall remain on file in his office for a period of six months after the occupation of such building, after which such drawings shall be returned by the Commissioner of Buildings to the person by whom they have been deposited with him, upon demand. It shall not be obligatory upon the Commissioner of Buildings to retain such drawings in his custody for more than six months after the occupation of the building to which they relate.

432. Approval of Plans by Other Departments.) All plans and drawings for the construction or alteration of any building or other structure for which building permits are required shall, before such permits are issued, be presented to the Commissioner of Health for examination and approval as to the proposed plan for the ventilation of rooms, light and air shafts, windows, the ventilation of water closets, drainage and plumbing. They shall also be presented to the Chief Fire Prevention Engineer for examination and approval with regard to such ordinances as are within the duty of such office to enforce. They shall also be presented to the Boiler Inspector and the Smoke Inspector in all cases where permits from these departments are required to be procured by the ordinances of the City.

433. Issuance of Permits.) All plans and drawings for the construction or alteration of any building or other structure for which a building permit is required may, at the option of the applicant for a building permit and by payment of a fee of one dollar for each plan, be filed in the office of the Commissioner of Buildings, and a receipt or check will be given for said plans which must be presented for the return of same after they have been examined and passed upon. The Commissioner of Buildings shall appoint a clerk with such necessary assistants whose duty it shall be, under the direction of the Commissioner of Buildings, to receive, take

charge of and return all plans and drawings filed as aforesaid. Every plan or drawing so filed in the office of the Commissioner of Buildings shall be forwarded by him successively to the Department of Smoke Inspection, the Department of Boiler Inspection, the Department of Public Works, the Bureau of Fire Prevention and the Sanitary Bureau, and there submitted to the proper officials of these respective departments and bureaus for examination and approval, and after said plans have been examined and passed upon, the Commissioner of Buildings shall cause said plans or drawings to be returned to his office where they shall be taken up for examination and approval by the Commissioner of Buildings. At the proper time notice shall be given by the Commissioner of Buildings to the applicant that his plans have been examined and are ready to be returned to him, and if such plans have been approved as submitted by the various departments and bureaus as aforesaid, the Commissioner of Buildings then shall, according to ordinance, issue a permit for the construction or erection of such building or structure.

434. Encroachment on Public Highway.) The Commissioner of Buildings shall not issue any permit authorizing the construction, erection repair or alteration of any building or structure unless the plans submitted for his approval clearly show that such building or structure with all its appurtenances, foundations and attachments can be erected entirely within the limits of the lot or tract of land upon which it is proposed to erect such building or structure, except as hereinafter provided, and except as otherwise provided by the ordinances of the City of Chicago, and no permit to erect, repair or alter any building or structure shall authorize the use of any part of any public highway or other public ground for the construction or maintenance of such building or structure except as hereinafter provided, and except as otherwise provided by the ordinances of the City of Chicago. nor shall any permit be issued for the construction or maintenance of any balcony or canopy extending over any public highway or other public ground unless permits therefor have been obtained from the proper department of the City Government, pursuant to an ordinance, specifically authorizing the same. The plans of every building or structure which show that any part of said building or structure or any of its appurtenances, or attachments thereto, extend over any part of any public highway or other public ground than hereinafter provided for shall, previous to being submitted to the Commissioner of Buildings, be submitted to the Commissioner of Public Works and notice thereby given to him of the proposed encroachment upon any public highway or other public ground. Proof of such notice to the Commissioner of Public Works must accompany plans when same are presented to the Commissioner of Buildings.

435. Cornices and Belt Courses.) The Commissioner of Buildings may issue permits for the horizontal cornices and belt courses so called to be constructed on buildings as follows:

Where all parts of a cornice of any building or structure are more than twelve feet above the inside grade of the sidewalk, and in cases where the sidewalk grade varies, are more than twelve feet above the average or mean inside grade of the sidewalk and where such cornice extends in whole or in part along the street frontage, of a building, and where the return of such cornice if any along an alley wall is not longer than a distance equal to the width of the alley, such cornice may project into the street or alley a distance of twenty-four inches. For each additional one foot in height such cornice is placed above the height of twelve feet as

aforesaid up to the limits of height fixed by ordinances for the particular building of which such cornice is a part, such cornice may project into the street or alley an additional one-quarter inch, until the total projection has reached the maximum of four feet six inches where the width of the street is less than sixty-six feet and to a maximum of five feet where the width of the street is sixty-six feet or more.

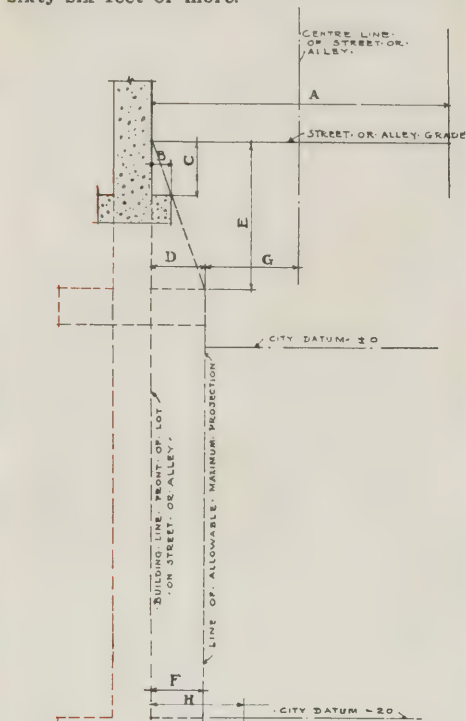


Fig. 1.

FOUNDATIONS.

See Section 436.

(A) Width of street.
Provision made for 16' 0" or over.

Provision made for less than 16' 0".

(B) Allowable projection.
A ratio of $4\frac{1}{2}$ " to every foot of (C).

(C) Depth of foundation below inside sidewalk grade or alley grade—See (B).

(D) Maximum allowable projection at point (E) 8' 0" below said sidewalk or alley grade = 3' 0".

(E) Point at depth of formation (8' 0") below sidewalk or alley grade where maximum projection begins. See (D).

(F) Allowable maximum projection from (E) to 20' 0" below plus or minus 0 city datum = 3' 0".
(G) For streets, alleys, etc., less than 16' 0" in width. Foundations may not be built nearer than (G) 5' 0" to middle line of streets or alleys, etc.

(H) Allowable projection below 20' 0" city datum to be determined so far as in the opinion of the Commissioner of Buildings is necessary.

Horizontal belt courses, water tables and other horizontal architectural features, which do not add floor area to a building or structure and which extend in whole or in part along the street frontage of a building with a return if any around an alley wall not longer than a distance equal to the width of the alley, and where all parts of such horizontal belt courses, water tables and other horizontal architectural

features are more than twelve feet above the inside grade of the sidewalk, may project into the street or alley a distance not to exceed eighteen inches.

436. Encroaching Foundations.) The Commissioner of Buildings may issue permits for buildings for which it is contemplated that there shall be projections of the foundation, or a part or parts thereof, into a public street, a public alley or a public thoroughfare under the following conditions: Where such street, alley or thoroughfare is sixteen (16) feet or more in width such foundations shall have no projection at the sidewalk or alley grade, but may project at the ratio of four and one-half ($4\frac{1}{2}$) inches to one (1) foot for each one (1) foot of depth such foundation may extend below the sidewalk or alley grade to a maximum projection of thirty-six (36) inches at a depth eight (8) feet below said sidewalk or alley grade, and such foundations, or such part or parts thereof, which are higher than a point twenty (20) feet below city datum and are lower than a point eight (8) feet below the sidewalk or alley grade, may project into such street, alley or thoroughfare for a distance not to exceed thirty-six (36) inches for such part of their extent as is included between a point eight (8) feet below the said sidewalk or alley grade and a point twenty (20) feet below said city datum, and, where said street, alley or thoroughfare is less than sixteen (16) feet in width, foundations, or any part or parts thereof, may project into such street, alley or thoroughfare at a ratio of four and one-half ($4\frac{1}{2}$) inches of projection to one (1) foot of depth, but no foundation, or part or parts thereof, shall be built nearer than five (5) feet to the middle line of such street, alley or thoroughfare. No foundation, or any part or parts thereof, shall project into a public street, a public alley or a public thoroughfare in such manner as to add area to the superstructure of any building or structure.

The construction of caisson and other types of foundations, part or parts of which may extend to a greater depth than twenty (20) feet below city datum, shall conform to the requirements of this section as hereinbefore contained in such part or parts as are higher than twenty (20) feet below city datum and lower than eight (8) feet below the sidewalk or alley grade and in such part or parts as are higher than eight (8) feet below the sidewalk or alley grade, but such part or parts of such last mentioned foundations as are constructed lower than twenty (20) feet below city datum may project into a public street, a public alley or a public thoroughfare so far as, in the opinion of the Commissioner of Buildings, is necessary for the stability of the building or structure of which they are a part.

It is expressly made a condition in the issuance of any permit for the construction of a building or structure whose foundations, or any part or parts thereof, project into a public street, a public alley or a public thoroughfare at any point higher than twenty (20) feet below city datum that if during the construction of or after the completion of such structure or building the said foundation or any part or parts thereof, shall project in such a manner as to interfere with or be an obstruction to the building of, maintaining, conducting or operating any public utility now or hereafter to be constructed, or any part or parts of any construction in connection therewith, that such projecting foundations, projecting part or projecting parts thereof, shall be subject to removal upon notice from the Commissioner of Public Works so to remove them. Such notice shall be in writing and shall allow such length of time as said Commissioner of Public Works shall

deem a reasonable time for the purpose of making the changes required thereunder, but the owner or owners of the said building or structure shall proceed at once upon receipt of said notice to remove all projecting part or parts of such foundations without any expense, loss or damage accruing to the City of Chicago. Upon failure of such owner or owners to comply with said notice by beginning the work required thereunder within thirty (30) days after the receipt of such notice or upon failure to complete same within such reasonable time thereafter as the Commissioner of Public Works shall deem sufficient, the Commissioner of Public Works may proceed at once to remove such projecting part or parts of such foundations and the City of Chicago may recover the cost and expense of such removal, unless otherwise reimbursed, by an action at law against the owner or owners, lessee or lessees of said premises.

437. Additional Plans Showing Projections—Structure with Foundation Below Minus 40 City Datum.) In addition to the general plan of the building or structure as required in other sections of this ordinance, a detailed plan drawn to a large scale of any proposed cornice or any projection contemplated in the two preceding sections shall be submitted to the Commissioner of Buildings for his examination and approval.

Whenever application is made for a permit to erect any building or structure, the foundations of which are designed to extend to an elevation of minus 40 Chicago datum, the plans of said building or structure shall be submitted to the City Engineer and his approval secured before a permit is issued for the erection of such building or structure by the Commissioner of Buildings; provided, however, that this requirement shall only apply within the district bounded as follows: starting at the intersection of the center line of east 12th street produced and the shore of Lake Michigan, thence west along the center line of east and west 12th street to the intersection of the center line of South Halsted street, thence north along the center line of South and North Halsted street to the intersection of the center line of West Chicago avenue, thence east along the center line of West and East Chicago avenue and East Chicago avenue produced to the shore of Lake Michigan, then southeasterly along the shore of Lake Michigan to the place of beginning; and, provided, further, that this restricted provision shall apply to all buildings or structures designed to be erected at any location within the city when the nearest point on any of said proposed buildings or structures is within two hundred feet of the shore line of Lake Michigan, the Chicago River or any of its branches, the Drainage Canal, Lake Calumet or the Calumet River.

438. Plans to be Kept on Work.) In all cases the approved plan, together with building permits, must be kept on the job while the work is in progress.

439. Plans—Essentials of.) All plans and drawings for buildings or for structures other than buildings shall be presented to the Commissioner of Buildings for his approval, and each set of plans presented shall be approved by the Commissioner of Buildings before a permit will be granted. All such plans and drawings shall be drawn to a scale of not less than one-eighth of an inch to the foot, on paper or cloth, in ink, or by some process that will not fade or obliterate. All distances and dimensions shall be accurately figured, and drawings made explicit and complete, showing the lot lines and the entire sewerage and drain pipes and the location of all plumbing fixtures within such building or structure. No permit shall be granted or plans approved unless such plans are signed and sealed either by an architect licensed to practice architecture under "The Illinois Architectural

Act," or by a structural engineer licensed to practice structural engineering under "The Illinois Structural Engineering Act."

440. Plans—Alterations Upon Stamped Plans Not Permitted—Certain Alterations Excepted.) It shall be unlawful to erase, alter or modify any lines, figures, or coloring contained upon such drawings so stamped by the Commissioner of Buildings or filed with him for reference. If, during the progress of the execution of such work it is desired to deviate in any manner affecting the construction or other essentials of the building from the terms of the application, or drawing, notice of such intention to alter or deviate shall be given to the Commissioner of Buildings, and his written assent shall first be obtained before such alteration or deviation may be made; but alterations in buildings which do not involve any change in their structural parts or of their stair ways, elevators, fire-escapes or other means of communication, or ingress or egress, or in lighting or ventilation and that are not in violation of any of the provisions of this chapter, may be made without the permission of the Commissioner of Buildings.

441. Deposit With Water Department—How Made—Indemnity Bonds—Fees for Water Used.) (a) Before the Commissioner of Buildings issues a permit as provided herein, he shall require evidence from the applicant that payment has been made to the Bureau of Water of the city for the water to be used or for a water meter for measuring all the water to be used in the construction of such building in accordance with the regulations of the Bureau of Water. Such applicant shall produce evidence that he has filed with and had approved by the Commissioner of Public Works of the city an indemnifying bond protecting the city against any and all damage that may arise to the streets or alleys upon which such building abuts and to the city and to any person in consequence, or by reason of, the proposed operations to be authorized by such permit, or by reason of any obstruction or occupation of any street or sidewalk in and about such building operations.

(b) The fees to be paid for water used in connection with the erection of buildings shall be as follows, to-wit:

At the rate of five cents for every one thousand bricks, wall measure, used in connection therewith.

At the rate of six cents for every one hundred cubic feet of rubble stone used in connection therewith.

At the rate of eight cents for every one hundred cubic feet of concrete used in connection therewith.

At the rate of fifteen cents for every one hundred yards of plastering used in connection therewith.

At the rate of five cents for every one hundred cubic feet of hollow tile arch, partition or fireproof covering used in connection therewith.

442. Amount of Permit Fees.) Amending certain sections of The Chicago Municipal Code of 1922 relating to building permit and inspection fees.

Be it ordained by the City Council of the City of Chicago:

Section 1. That Section 442 of The Chicago Municipal Code of 1922 be and the same is hereby amended to read as follows:

October 31, 1929.

"442. Amount of Permit Fees.) (a) The fees to be charged for building permits shall be as follows: For sheds not exceeding four hundred square feet in area, three dollars; for open shelter sheds, at the rate of two dollars for each one thousand cubic feet or fractional part thereof; for all buildings or other structures, other than sheds and open shelter sheds, as herein-after described, the fee for the permit shall

be at the rate of thirty cents for every one thousand cubic feet or fractional part thereof for buildings containing not to exceed two hundred thousand cubic feet of volume. For buildings exceeding two hundred thousand cubic feet in volume thirty cents per thousand cubic feet for the first two hundred thousand cubic feet and sixty cents per one thousand cubic feet for each additional one thousand cubic feet of volume or fractional part, the cubic contents being measured to include every part of the building from the basement floor to the highest point of the roof, and to include all bay windows and other projections; but in no case shall any permit be issued for a less fee than two dollars.

(b) The fee to be charged for permits issued for alterations and repairs in or to any building or other structure shall be based on the cost of such alterations and repairs and shall be at the rate of two dollars for the first one thousand dollars or part thereof, and one dollar additional for each one thousand dollars or part thereof to be expended therefor. The fee for permit to raise any building other than a frame building shall be for raising, shoring up, underpinning or moving any building other than a frame building twenty cents per one thousand cubic feet of volume or fractional part thereof: Provided, however, that in no case shall a permit be issued for a less fee than five dollars.

(c) In addition to the above permit fees for buildings, permit and inspection fees shall be charged as follows:

For erection of fire-escape, five dollars minimum to include fire-escapes up to four stories in height; and seventy-five cents additional for each story above four stories in height;

For installation or alteration of elevator, five dollars;

For semi-annual inspection of elevator, five dollars;

For erection of billboards or signboards, five dollars for every twenty-five lineal feet or fractional part thereof;

For erection of illuminated and other roof signs under Section 919 of this chapter, seventy-five dollars for the first five hundred square feet of superficial area or fractional part thereof and ten cents for each additional square foot area;

For annual inspection of billboard or signboard, two dollars for every twenty-five lineal feet of billboard or signboard or fractional part thereof;

For annual inspection of illuminated and other roof signs under Section 919 seventy-five dollars for the first five hundred square feet or fractional part thereof, ten cents additional for each additional square foot area;

For semi-annual inspection of iron or steel curtain, fifteen dollars;

For semi-annual inspection of asbestos curtain, five dollars;

For permit for tank on roof or tower in excess of four hundred gallon capacity, ten the roof of any building, ten dollars;

For permit for isolated chimneys or for chimneys extending over fifty feet above the roof of any building, ten dollars;

443. Permit for Wrecking Building—Bond.)

(a) Before proceeding with the wrecking or tearing down of any building or other structure more than one story in height, a permit for such wrecking or tearing down shall first be obtained by the owner or his agent from the Commissioner of Buildings, and it shall be unlawful to proceed with the wrecking or tearing down of any building or structure or any structural part of such building or structure unless such permit shall first have been obtained. Application for such permit shall be made by such owner or his agent to the Commissioner of Buildings, who shall issue such permit upon such application and the payment of the fee here-

in provided for. Such application shall state the location and describe the building which it is proposed to wreck or tear down. The fee for such permit shall be five (\$5.00) dollars for every twenty-five feet, or fractional part thereof, of frontage. Upon the issuance of such permit, such building may be wrecked or torn down, provided that all the work done thereunder shall be subject to the supervision of the Commissioner of Buildings and to such reasonable restrictions as he may impose in regard to elements of safety and health, and provided, further, that the work shall be kept sprinkled and sufficient scaffolding be provided to insure safety to human life, and to comply with the Provisions of the Act of the General Assembly, Passed June 3, 1907, in force July 1, 1907, Providing for the safety of workmen in and about the construction and removal of buildings.

(b) Before any permit is issued granting authority to wreck a building or structure for which such permit is required, the person, firm or corporation engaged in the work of wrecking same shall file with the City Clerk a bond with sureties to be approved by the City Comptroller to indemnify, keep and save harmless the City against any loss, cost, damage, expense, judgment or liability of any kind whatsoever which the City may suffer, or which may accrue against, be charged to or be recovered from said City, or any of its officials, from or by reason or on account of accidents to persons or property during any such wrecking operations, and from or by reason or on account of anything done under or by virtue of any permit granted for any such wrecking operations. Such bond in each case shall extend to and cover all such wrecking operations carried on through permits obtained thereunder by such person, firm or corporation during any fiscal year beginning January first and ending December thirty-first, and no permit shall be issued for any wrecking work except as hereinbefore otherwise provided during such fiscal year until such bond is filed. Said bond shall be in the penal sum of twenty thousand dollars for all wrecking operations on such buildings and other structures not more than three stories in height, and there shall be an additional bond filed in the penal sum of twenty thousand dollars or a bond in the penal sum of forty thousand dollars shall be filed in the first instance in case of wrecking operations on buildings and other structures four or more stories in height. Upon the filing of such bond or bonds the person, firm or corporation engaged in the work of wrecking such buildings and other structures may obtain permits for such wrecking operations as are authorized under the said bond or bonds as hereinabove provided for during the fiscal year in which the same is or are filed: Provided, that, in case of accident or casualty in the progress of any wrecking operations carried on under any permit so issued, or the happening of any circumstance which might in the opinion of the Commissioner of Buildings render such bond or bonds inadequate, the said Commissioner may, in his discretion, require such additional bond as he may deem necessary to fully protect the city from loss resulting from the issuance of such permits before he allows the work to proceed or before any additional permits are issued by him.

444. Permit—Revocation of.) If the work in, upon or about any building or structure shall be conducted in violation of any of the provisions of this chapter, it shall be the duty of the Commissioner of Buildings to revoke the permit for the building or wrecking operations in connection with which such violation shall have taken place. It shall be unlawful, after the revocation of such permit, to proceed with such building or wrecking operations unless such permit shall first have been

re-instated or re-issued by the Commissioner of Buildings. Before a permit so revoked may be lawfully re-issued or re-instated, the entire building and building site shall first be put into condition corresponding with the requirements of this chapter, and any work or material applied to the same in violation of any of the provisions of this chapter shall be first removed from such building.

445. Annual Inspection of Buildings—Revolving Doors—Stairways and Means of Egress—Inspection Fee.) (a) The Commissioner of Buildings and his assistants shall make an annual inspection of all theaters and places of amusement, worship, instruction or entertainment, and also of all other buildings over two stories in height, except residences, and except buildings in which automobiles are housed, and except tenements three stories or less in height. It shall be the duty of every owner, agent, lessee or occupant of any such building as is referred to in this section and of the person in charge or control of same to permit the making of such annual inspection by the Commissioner of Buildings, or by a duly authorized Building Inspector, at any time upon demand being duly made.

(b) Whenever any such inspection shows the building to be in compliance with the requirements of this Chapter with respect to stairways, means of egress, and in all other respects, it shall be the duty of the Commissioner of Buildings to issue, or cause to be issued, a certificate setting forth the result of such inspection, containing the date thereof, and a statement to the effect that such building complies in all respects with the provisions of this Chapter, upon the payment of the inspection fee herein required.

(c) It shall be the joint and several duty of the owner, agent, lessee or occupant of the building so inspected and of each and every person in charge and control of the same to frame the said certificate and place it in a conspicuous place near the main entrance of such building.

(d) It shall be the joint and several duty of the owner, agent, lessee or occupant of every building described in this section to provide a typical floor plan of such building reproduced on a sheet eight by ten inches in size. Said plan shall be drawn on as large a scale as will be practicable on such sheet, and said sheet shall also state the street address of such building, and shall give the class of the building, the kind of construction used therein, the height and number of stories contained therein and the nature of the occupancy.

(e) It shall also be the joint and several duty of such owner, agent, lessee or occupant to deliver a copy of said sheet to the Commissioner of Buildings and to frame a copy of said sheet and place the same near the framed certificate hereinabove required.

(f) It shall also be the joint and several duty of the said owner, agent, lessee or occupant to substitute a new sheet for the sheet on file with the Commissioner of Buildings, and also the sheet framed as above required, whenever such changes or alterations are made in such building as will affect the substantial accuracy of the sheet previously furnished such Commissioner and framed as above required.

(g) Where the result of such inspection shall show that such building fails in any respect to comply with the requirements of this Chapter, it shall be the duty of the Commissioner of Buildings to notify the owner, agent, lessee or occupant of such building to this effect and to specify wherein such building fails to comply with the requirements of this chapter; and it shall thereupon become the joint and several duty of such owner, agent, lessee or occupant to proceed forthwith to make whatever changes

or alterations may be necessary to make such building comply in all respects with the requirements of this chapter and to complete such changes and alterations within thirty days after the receipt of such notice.

(h) Upon making such annual inspection, it shall be the duty of the owner to pay to the City Collector an annual inspection fee for the same, amounting to five dollars where the said building contains not to exceed 25,000 square feet of floor area. Where the building has a floor area in excess of 25,000 square feet, annual inspection fee of five dollars shall be paid for the first 25,000 square feet of floor area and for each additional 25,000 square feet of floor area thereof, an additional fee of three dollars shall be paid: Provided, however, that no charge for such annual inspection shall be made against religious, charitable or educational institutions.

(i) Every revolving door now in operation or which may hereafter be installed, together with all the equipment and mechanism thereof shall be inspected semi-annually, under and by authority of the Commissioner of Buildings.

Whenever such inspection shows a revolving door to be in good working order and in compliance with the Ordinances of the City of Chicago pertaining to revolving doors and their use as exit doors, the Commissioner of Buildings shall issue, or cause to be issued, a certificate to that effect; and for each such inspection and certificate a fee of three dollars shall be charged. Provided, however, that revolving doors affording exit from ground floor premises used by one person, firm or corporation, shall be exempt from the semi-annual inspection and fee requirements of this paragraph, where such exit door has no connection with or affords no exit facilities to any other floor of the building or to any premises or space occupied or used by any other person, firm or corporation.

446. Architect Must Certify That Plans Comply With the Building Ordinances.) It shall be unlawful for any architect, or other person permitted under the laws of the state to make plans, to prepare or submit to the Commissioner of Buildings for his approval any final plans for any building or structure which do not comply with the structural requirements of this chapter. It shall be the duty of the Commissioner of Buildings to require that all plans submitted to him for approval for any building or structure shall be accompanied by a certificate of such architect or such other person preparing such plans that the plans submitted comply with the structural requirements of this chapter.

447. Constructing Buildings Contrary to Approved Plans—Permit Made Void by Deviation from Plans—Power to Stop Work.)

(a) It shall be unlawful for any owner, agent or architect, or for any contractor or builder engaged in erecting, altering or repairing any building, to make any departure from the plans as approved by the Commissioner of Buildings of such nature that such departure involves any violation of the requirements of this chapter as to buildings of the class in which such building belongs, or to make any changes in plans or construction affecting means of egress, ventilation, natural lighting, or sanitary conditions without first obtaining the written consent of the Commissioner of Buildings and of the Commissioner of Health to such changes. Any such departure from the approved plans involving a violation of the requirements of this chapter or any such change in the plans or construction without the consent of the Commissioner of Buildings and the Commissioner of Health being obtained, as required herein, shall operate to annul the permit which has been issued for such work and shall render the same void.

(b) In case any work is done under a permit authorizing the erection, alteration

or repair of a building or structure, which work is contrary to the approved plans, the Commissioner of Buildings or the Commissioner of Health and their assistants shall have power to at once stop such work and to order all persons engaged therein to stop and desist therefrom. Such work shall not be resumed until satisfactory assurance has been given to the Commissioner of Buildings or the Commissioner of Health, as the case may be, that it will be done according to the approved plan or until said Commissioner of Buildings or Commissioner of Health has consented in writing to the changes made in such approved plans, and if such changes in the approved plan involve additional work a new permit or an extended permit shall be issued for which an additional fee shall be paid by the contractor doing such work.

(c) No contractor or builder shall begin any work on any building or structure for which a permit is required until such permit shall have been secured. In case any work is begun on the erection, alteration, repair or removal of any building or structure without a permit authorizing the same being issued therefor, the Commissioner of Buildings and his assistants shall have power to at once stop such work and to order any and all persons engaged therein to stop and desist therefrom until the proper permit is secured.

ARTICLE III.

Classification of Buildings.

448. **Buildings—Classification of.** (a) All buildings other than sheds and shelter sheds as hereinafter described, now existing or hereafter erected, altered or enlarged, shall be classified as follows:

(b) **Class I.** In Class I shall be included every building used for the sale, storage or manufacture of merchandise, other than department stores as described in this chapter. Also such buildings, structures or places with a ground area of five hundred square feet or more used as and for the purposes of a barn, stable or a garage or for the housing or keeping of automobiles.

(c) **Class II.** In Class II shall be included every building referred to in subdivisions Class IIa, Class IIb and Class IIc.

(d) In Class IIa shall be included every building used for office purposes, and also every building used for club house purposes where sleeping accommodations are provided for less than twenty persons.

(e) In Class IIb shall be included every building used for hotel, club, lodging or rooming house purposes where such building has sleeping accommodations for twenty or more persons.

(f) In Class IIc shall be included every building used for a hospital where sleeping accommodations for more than ten persons are provided in such building, and every building used for a home, day nursery or asylum where any such building shall have accommodations for more than twenty persons or where more than ten bedridden or decrepit persons are housed, and every building used for a jail, house of correction or detention.

(g) **Class III.** In Class III shall be included every building used as a private residence, also every building used for a hospital where sleeping accommodations for ten or less persons are provided in such building, and every building used for a home, day nursery or asylum where any such building shall have accommodations for not to exceed twenty persons or where not to exceed ten bedridden or decrepit persons are housed, and also every building, structure or place with a ground area of less than five hundred square feet used as and for the purposes of a barn, stable or garage or for the housing or keeping of automobiles.

(h) **Class IV.** In Class IV shall be included every building referred to in subdivisions Class IVa, Class IVb, Class IVc, and Class IVd, as follows:

(i) In Class IVa shall be included every building used as a church or place of worship.

(j) In Class IVb shall be included every building having a parish hall, Lodge hall, dance hall, banquet hall, skating rink, assembly hall, halls used for the purpose of exposition and exhibition, and buildings having a hall for the purpose of instruction other than schools, included in Class VIII, and also every existing building having a hall used for theatrical purposes at the time of the passage of this ordinance, except such buildings as are included in Classes IVa, IVc, IVd, and V.

(k) In Class IVc shall be included every building hereafter erected used for moving picture and vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, and where the seating capacity does not exceed three hundred persons, provided, that every building of Class IVc existing at the time of the passage of this ordinance shall comply with the provisions of Class IVb.

(l) In Class IVd shall be included every grand stand and every baseball athletic and amusement park.

(m) **Class V.** In Class V shall be included every building which is used as a public theatre where an admission fee is charged and in which movable scenery is used, and every assembly hall hereafter erected having a seating capacity of over 300 persons and containing a permanent stage or which scenery and theatrical apparatus are used and regular theatrical vaudeville performances are given; provided, however, that public halls and club halls with a seating capacity of less than 600 persons although occasionally used for theatrical presentations, shall not be construed to be public theatres within the meaning of the term as used in this section, notwithstanding the fact that movable scenery is used upon the stages thereof on such occasions, and such public halls and club halls shall not be considered as buildings of Class V as herein defined. Such public halls and club halls shall be included in Class IVb, as defined in this section.

(n) **Class VI.** In Class VI shall be included every tenement and apartment house or building or portion thereof which is used or intended to be used as a home or residence for two or more families living in separate apartments.

(o) **Class VII.** In Class VII shall be included every building used for the sale at retail of dry goods and other articles of general merchandise and commonly known and described as a department store.

(p) **Class VIII.** In Class VIII shall be included every building used for school purposes and every building containing class rooms for special or general instruction, other than halls for the purpose of instruction as included in Class IV, where such building so used shall have a seating capacity of more than fifty students.

(q) **Class IX.** In Class IX shall be included every building maintained by the City of Chicago for police station purposes.

(r) Requirements with regard to buildings not within any of the above classes shall be determined by the Commissioner of Buildings subject to arbitration in the same manner as provided in Sections 407 and 408 of this chapter.

449. **Buildings Used for the Purposes of More Than One Class.** Where any building is used for the purposes of two or more classes, as herein specified, and defined, such portion of any such building as is devoted

to the uses and purposes of any particular class shall be constructed, operated and maintained in accordance with the requirements of this chapter relating to such class, unless such construction shall, in the opinion of the Commissioner of Buildings, prove impracticable, or unless there would be a conflict between the provisions of this chapter relating to the construction of buildings, in either of which cases the construction requirements which relate to and govern the construction of buildings of the class requiring the best and safest form of construction shall govern the entire building; provided, however, that in any building exceeding twenty stories in height, where such building is used to house five or more self-propelled vehicles in addition to other uses, and not more than one-third of such building is so used for the housing of five or more self-propelled vehicles; and such building is throughout of fireproof construction and the portion of such building so used for the housing of five or more self-propelled vehicles is completely separated by fireproof walls and fireproof roof from the remainder of the building such portion of said building so used for the housing of five or more self-propelled vehicles shall comply with the requirements for class I buildings as set forth in this chapter, and the remainder of such building shall comply with the requirements of the class of buildings applicable to the purposes for which such portion of said building is to be used.

Passed, July 22, 1925.

450. Conflict Between Special and General Provisions.) Whenever any provision or requirement of this chapter relating specifically to the construction, equipment, maintenance, or operation of any building or part of a building used for the purpose of any specified class, shall conflict with the general provisions of this chapter relating to the construction, equipment, maintenance and operation of buildings generally, the special provisions shall govern in each case, except in the case of Section 705, which shall govern in all cases coming within its provisions.

ARTICLE IV.

Buildings of Class I.

451. Class I Defined.) In Class I shall be included every building used for the sale, storage or manufacture of merchandise, other than department stores as described in this chapter. Also such buildings, structures or places with a ground area of five hundred square feet or more used as and for the purpose of a barn, stable or a garage or for the housing or keeping of automobiles.

452. Must Comply With General and Special Provisions.) Every building of Class I shall comply with the general provisions applicable to the kind of building it is as set forth in this chapter and shall, in addition, comply with the following special provisions.

453. Buildings—Construction of—in Relation to Height.) (a) The construction of buildings of Class I shall be as follows: Buildings of Class I which are 100 feet in height or higher shall be built of fireproof construction.

(b) Buildings of Class I which are less than 100 feet in height and more than 50 feet in height shall be built of slow-burning, mill or fireproof construction. Buildings of Class I of slow-burning or mill construction shall not be built more than seven stories in height.

(c) Buildings of Class I of ordinary construction shall not be built more than four stories in height.

454. Skeleton Steel Walls—Metal Lath and Solid Cement Plaster Covers.) (a) A one or two story building used for the purposes of Class I, no part of which is within twenty feet of any lot line, alley line or street line, having a complete self-supporting

steel frame consisting of wall columns, supporting steel trusses, with steel trusses and steel diagonals, designed to resist safely, within the safe limits of stress provided by this chapter, a wind pressure of twenty pounds per square foot, for each and every exterior surface exposed to the wind, in addition to the dead weight of the completed structure, and in addition to the live load of 100 pounds per square foot provided for by this chapter, and any other live loads which may be imposed on such structure, may have exterior walls measuring not less than one and one-third inches thick of metal lath or metal fabric plastered on both sides with a mortar consisting only of Portland cement and torpedo sand. Complete reinforced concrete framework, built in every manner equally as strong and as safe as provided for a steel frame, in this section, may have exterior walls built in the same manner of the same materials and of the same thickness.

(b) The enclosing walls of buildings which are built not less than fifty feet from any lot, alley or street line may be constructed of corrugated iron, supported on a steel frame built as specified in this section.

455. Buildings for Explosives.) (a) Buildings for the storage of fireworks and of similar substances or articles of an explosive nature shall have walls of masonry construction, shall not exceed one story in height, shall not exceed sixteen hundred (1,600) square feet in area unless such building is divided into areas of sixteen hundred (1,600) square feet or less by dividing walls the construction of which and the equipment of openings in same being in compliance with the requirements of Section 463 of this chapter. The roof of such building may be constructed of wood joists and roof boards covered with incombustible material or of wood joists covered with sheet metal or of common glass set in metal frames, but in every case at least thirty (30%) per cent of the area of such roof shall be constructed of common glass and metal frames. Such buildings shall be situated not less than one hundred feet from any other building or structure and shall be situated not less than one hundred feet from any lot line, or where such lot line abuts a street, alley or public thoroughfare said building shall be situated not less than one hundred feet away from the opposite side of such street, alley or public thoroughfare.

(b) Buildings erected for the collection or compression of acetylene gas at a pressure of exceeding fifteen (15) pounds to the square inch shall be of fireproof construction throughout and shall be located at least two hundred and fifty feet away from any other building or structure and at least two hundred and fifty feet from any lot line and any street, alley or public thoroughfare.

456. Buildings for Housing Motor Driven Vehicles.) (a) Every building or structure hereafter erected and every existing building or structure hereafter increased in size or otherwise altered or hereafter converted or used for the purpose of housing five or more self-propelled vehicles or other wheeled machines, containing in the tanks thereof volatile inflammable liquid for fuel or power, and all adjoining buildings and structures not separated therefrom by dividing walls of brick or concrete extending at least three feet above the roof and having openings, if any, protected on both sides by approved automatic fire doors, where such building or structure is more than one story and less than four stories in height shall be of fireproof construction throughout, or shall be equipped throughout with an automatic sprinkler system. Where any such building is two stories or less in height and complies in all other respects with the requirements for fireproof construction and the second floor area is co-extensive with the area of the building and without openings

other than for stairs and elevators, such one or two-story building as aforesaid may have a roof of ordinary, slow-burning or mill construction. Where any such building two stories or less in height has a mezzanine floor or floors with a total area larger than twenty per cent of the area of the building it shall be considered an additional floor and that part or those parts of building containing such additional floor or floors shall be separated from every other part of said building by a wall of brick or concrete built of thickness as required for enclosing walls by the provisions of this chapter, and such parts of building so separated by such dividing wall shall have no openings in their floors from story to story other than is required for stairs and elevators. The openings connecting the different areas of such buildings shall be protected by double automatic fire door equipment. Every such building or structure more than three stories in height shall be of fireproof construction throughout and shall be equipped throughout with an automatic sprinkler system. In all such buildings more than two stories in height all window openings, except in walls that adjoin a public street fifty feet or more in width, shall be equipped with approved metal frames and sash glazed with wired glass. Buildings less than three stories high shall comply with the requirements of Section 784 of this chapter. All floor openings in non-fireproof buildings shall be enclosed in walls of masonry of such thickness as required by the provisions of this chapter and shall extend from the ground through the roof of the building; in fireproof buildings, all elevator shafts and other vertical shafts except stairways shall be enclosed in every story with walls of brick, tile, plain or reinforced concrete at least eight inches thick, all stairways shall be enclosed in every story with walls of brick, tile or reinforced concrete at least four inches thick and all openings in such enclosing walls shall be equipped with approved automatic or self-closing fire doors. There shall be no basement in any such building, except for boiler room purposes, unless such building, including the roof and the protection of the roof beams and roof girders, is of fireproof construction throughout and is equipped throughout with an automatic sprinkler system, and with no floor openings between the basement and other floors, except for stairs and elevators, and such openings shall be enclosed in both the basement and first floor by walls of brick or concrete at least eight inches thick or of fireproof tile at least twelve inches thick and equipped with doors as hereinbefore specified. There shall be no openings from the boiler room except to the outside of the building. Where such building is on a lot that adjoins two streets or a street and an alley whose established grades are not at the same elevation the story whose floor is higher than two feet below the lower of these grades shall, for the purpose of this section, be deemed the first story of said building.

Buildings of fireproof construction, except buildings used as hospitals, theaters, churches, schools and public halls, may be used to house self-propelled vehicles, provided, however, that the portion of the building used for such housing is separated from all the other portions of the building; which separation shall be by walls or floors of solid brick or concrete, not less than twelve inches thick, having no openings into the other portions of the building. The floors of said portion of such buildings used for such housing shall be of solid concrete construction. All openings from floor to floor shall be enclosed with twelve-inch brick or concrete walls; all doors on these walls around floor openings to be standard metal fire doors, and shall be of a self-closing or automatic type. The portion of such buildings housing self-propelled vehicles shall be equipped

with an approved automatic sprinkler equipment. All such buildings of eighty feet or more in height shall be equipped with inside standpipe fire lines subject to the approval of the Fire Commissioner. Where the floor area on one floor used for the purpose of housing self-propelled vehicles is in excess of 5,000 square feet, three sides of such portion of such buildings shall be at least fifteen feet removed from any other structure or building. Floor areas on one floor shall not exceed 12,000 square feet. Floor areas in excess of 12,000 square feet shall be divided into areas of 12,000 square feet, or less, by standard fire walls of twelve-inch brick or concrete, all openings in same to be protected by standard double automatic fire doors. The entrance to and exit from each floor containing self-propelled vehicles shall be by means of a fire shield stairway tower. All openings from said stairway tower shall lead to a platform open on one side to the open air, the open side to be protected by an approved railing or grating, and the opening to approximate 80 per cent of the wall area. All doors leading to this open platform to be standard metal self-closing fire doors. There shall be installed a vent shaft in that portion of the building housing self-propelled vehicles, equal to four square feet in cross-section area for each five cars capacity. Such vent shaft shall not be required where three sides of the compartment housing self-propelled vehicles open to a space of fifteen feet or more. This vent shaft shall be in addition to the normal ventilating requirements, and together with its appurtenances shall be installed in such manner as will meet with the approval of the Fire Commissioner.

Passed, July 22, 1925.

(b) Every building, structure or place not now used for the housing of four or less vehicles containing volatile inflammable liquid in the tanks thereof but hereafter converted to such use, and every building or structure hereafter erected for the housing of four or less such vehicles, where so used, must be occupied and used exclusively for such purposes under the following conditions and with the exceptions hereinafter noted:

Frame sheds or buildings may be so used if such shed stands at least five feet from every other building or structure on the same lot or plot of ground; provided, however, that in frame buildings used exclusively for Class I purposes a portion of such building may be so used if the part so occupied is separated from all other parts of the building by a brick dividing wall extending three feet above the highest point of the roof, and in such dividing wall all openings, if there are any, shall be equipped with standard automatic or self-closing fire doors on each side of the wall.

Brick buildings with roof of ordinary construction may be so used if they are located three feet or more from every other building or structure upon the same lot or plot of ground. In buildings of ordinary, slow-burning or mill construction used exclusively for Class I purposes, four or less such vehicles may be housed provided that part of the building so occupied is separated from all other parts of such building by a brick wall extending three feet above the highest point of the roof and in which the openings, if any, are equipped with approved automatic or self-closing fire doors on each side thereof. If such building is more than one story high in lieu of extending hereinbefore required wall through the upper stories and through the roof as described, the floor system immediately above space in which such vehicles are kept may be built of fireproof construction connecting with wall separating such space from other parts of the building and which is carried through the story so occupied by such vehicles.

Brick buildings with a roof of fireproof construction may be so used and may ad-

join any other building or structure, but no openings shall connect the same with any building other than a building of Class I.

Buildings containing not to exceed one living apartment and in which four or less vehicles containing volatile inflammable liquid are housed, must have brick or masonry walls and not exceed two stories in height. The floor of the second story shall be of fireproof construction throughout or if of combustible material shall be protected on the underside for the entire area of such floor by two complete coverings of metal lath and fire-resisting plaster applied separately. There shall be two stairways from said apartment to the ground placed as far apart as practicable, one of such stairways may be an outside stairway. The interior stairway or stairways shall be enclosed on the first floor by partitions of four-inch tile or partitions of metal lath and plaster on metal studding in such a manner that exit by means of the stairway shall be direct to the outside of building, and there shall be no doorways or other openings from enclosure containing such stairway into the first story.

457. Buildings for Smoking Meats.)

Buildings or structures for the purpose of smoking meats or fish shall have brick walls and shall have a roof of fireproof construction. No combustible material shall be used in the erection of such building. Where smoke houses are built inside of another building, they shall be constructed entirely of metal or have brick walls with a fireproof roof or ceiling and no combustible material shall be used in their construction.

458. Buildings for Dry Cleaning.) Buildings in which machinery and equipment is installed for the purpose of dry cleaning shall stand at least fifty feet from any lot line and not nearer than fifty feet to the nearest point of approach of any other buildings or structure upon the same lot. Such buildings shall be of fireproof construction, shall not be over two stories in height and shall have no basement or attic. Walls shall be at least twelve inches thick. All window openings in outside walls shall be equipped with approved metal frames, metal sash and wired glass. All exterior and interior door openings shall be equipped with an approved three-ply laminated door covered with sheet metal or its equivalent in fire-resisting quality. There shall be no floor openings except for one interior stairway and said stairway shall be enclosed upon the first floor in such a manner as to give direct exit from stair and stair hall to the outside without any doorway or other opening from stair or stair hall to first story of building. An additional outside metallic stairway or additional stairways at least three feet wide shall also be provided. The boiler shall be located in a separate building and so situated that the line of travel for gases between any opening in boiler room and the opening in the dry cleaning or dry room shall be not less than twenty feet. Such dry cleaning and dry room shall be provided with vent holes at the floor line not less than sixteen square inches in area, at least six feet apart.

459. Buildings for Motion Picture Films.)

Buildings for the storage of more than two thousand (2000) feet of motion picture films, or buildings in which more than two thousand (2000) feet of motion picture films are stored shall be of ordinary, slow-burning, mill or fireproof construction and not more than two stories high, unless of fireproof construction. In all buildings in which motion picture films are stored all elevators and stairs shall be enclosed in all stories where such film storage occurs, and in all stories above such stories where motion picture films are stored. In buildings of ordinary construction such stair and elevator enclosure shall be of brick walls at least

twelve (12) inches thick supported on the ground or upon fire-proofed structural steel. In fireproof buildings all elevators and stairs shall be enclosed with brick walls at least eight (8) inches thick, or with reinforced concrete or with fireproof tile at least four (4) inches thick.

Vaults for the storage of motion picture films in non-fireproof buildings shall be of brick or of reinforced concrete at least twelve (12) inches thick. The floors and tops of such vaults shall be of brick or of concrete or of reinforced hollow tile at least twelve (12) inches thick, or of reinforced concrete at least eight (8) inches thick. In fireproof buildings vault walls shall be of either fireproof tile, brick, concrete or reinforced concrete. The floors and tops shall be of brick or of concrete at least twelve (12) inches thick, or of reinforced concrete at least eight (8) inches thick, or of fireproof tile or of reinforced hollow tile at least ten (10) inches thick. The thickness of vault walls shall be the same as herein specified for floors and tops where the same material is used for their construction, except that walls of fireproof tile shall be at least twelve (12) inches thick.

The vent flues for vaults shall be of the same construction as is required for smoke flues of the same area for such buildings. In fireproof buildings such vent flues may have walls at least four (4) inches thick of stone or gravel concrete reinforced with three-eighths ($\frac{3}{8}$) inch diameter round steel rods. Rods shall be set both vertically and horizontally, shall be spaced twelve (12) inches on centers where set horizontally and shall be spaced eighteen (18) inches on centers where set vertically. Or the walls may be four (4) inches thick of hollow clay tile set with the voids vertical and having all voids filled with stone or gravel concrete and with all joints filled with cement mortar and have metal bands at least one-fourth ($\frac{1}{4}$) inch thick by one (1) inch wide embedded within the horizontal joints on all sides of the flue at intervals of not less than four (4) feet in height such bands being secured to metal plates four (4) inches square and one-fourth ($\frac{1}{4}$) inch thick placed flat against the outside face of the tile, or bands shall be secured to each other in a manner to effectually prevent walls of the flue from spreading when subjected to heat. Where two or more flues are built together the bands may extend from outside to outside of the group or be arranged in such a manner as to effectually prevent the spreading of the walls of any flue within the group. Where tile is used for flues the exterior walls of detached flues or the outside walls of a group of flues shall be covered with two coats of cement plaster on wire lath brought close to the intersecting walls, floors and ceiling. Above the roof level tile walls shall be encased with four (4) inches of brick laid in cement mortar. Vent flues for vaults which are located in the top story of a fireproof building may be constructed of No. 14 U. S. gauge metal from the vault connection to the termination of the flue, and all that portion of the flue which is within the building and all that is not more than eighteen (18) inches above the roof shall have a coating of asbestos plaster at least two (2) inches thick covered with two coats of cement plaster on metal lath. Such other construction of vent flues will be permitted as will meet with the approval of a Board consisting of the Commissioner of Buildings and the Chief Fire Prevention Engineer and shall be regarded by such board as being equal in character and fire-resisting qualities to the foregoing.

In buildings of fireproof construction rooms for examining and for repairing motion picture films shall be enclosed in partitions of fireproof or incombustible material at least four (4) inches thick.

In buildings of fireproof construction rooms used for receiving, distributing or the shipping of motion picture films shall be enclosed in partitions or walls of brick or concrete or fireproof tile at least eight (8) inches thick, or of reinforced concrete at least six (6) inches thick.

Such partitions and the enclosing walls of such rooms, except where they face upon a public street at least fifty (50) feet wide, shall have window openings in same equipped with approved metal frames and sash and glazed with wired glass, and all door openings shall be equipped with approved single automatic-closing fire doors.

In non-fireproof buildings in addition to all of the above requirements, the floors and ceilings of such rooms or compartments must be of fireproof construction as defined in this chapter.

460. Door Openings—Revolving Doors.)

(a) The aggregate width of door openings at or approximately at the street level in buildings of Class I shall be equal to the aggregate width of stairways, as specified in Section 878 of this chapter for buildings of Class I. Where locks are used on exit doors or on doors or gates leading to hallways or stairways which lead to exit doors they shall be so arranged that the door or gate may be opened from the inside without the use of a key. Where locks are used on automatic fire doors in stair shafts of buildings in which approved sprinkler systems are installed, said doors may contain just above the locking device a fire-resisting glass panel containing not less than 81 square inches nor more than 450 square inches of exposed fire-resisting glass. In every building of this class every door to an exit which is a means of egress for twenty or more persons shall open outward, and every door which is a means of exit from any floor above the first, shall open outwardly from the space or hallway in which the stairway from such upper floor is located. A door or doors when open shall not project over a public sidewalk or public space.

(b) Revolving doors shall not be installed in any door opening of any building unless the revolving wings of such revolving doors are so arranged that, by the application of a force slightly more than is necessary to revolve said doors and which one person of ordinary strength is capable of exerting, all the wings of said door fold flat on each other and in an outward direction, or unless the revolving wings of said revolving doors are so arranged that they may be readily collapsed or removed by pressure or simple mechanical means, to be approved by the Commissioner of Buildings, and leave sufficient opening for two or more persons to pass through with a minimum width of not less than twenty-two inches on each side of said collapsed doors.

Where revolving doors are used as exits they shall be credited as exits only to the extent of the clear space remaining when the doors are collapsed and all deficiency of required exits must be made up by additional doors.

461. Existing Buildings of Class I—Increasing Height of.) In all cases where buildings of Class I of ordinary construction built prior to March 13, 1911, are to be increased in height above the height of fifty feet, or of mill or slow-burning construction above the height of ninety feet, the additional parts of such buildings shall be constructed as herein provided for buildings over fifty feet in height or over ninety feet in height, respectively, and said additional parts shall be made to conform in all respects to the requirements for buildings of this class more than fifty feet in height or more than ninety feet in height, respectively, before it shall be lawful to occupy them.

462. Fire Walls.) (a) Buildings occupied by more than one person, firm or cor-

poration, or for more than one business enterprise conducted by the same person, firm or corporation, in separate enclosures on any one floor, shall have a brick dividing wall for every fifty feet of street frontage, if of ordinary construction, or for every eighty feet of street frontage, if of slow-burning or mill construction, and such dividing walls shall extend from the front to the rear wall and such dividing walls and the doors therein shall be built in accordance with the provisions of Section 789 of this chapter.

(b) All of the partitions between the parts of such buildings occupied by different persons, firms or corporations, shall be built of incombustible material from the floor to the floor boards or roof boards next above such story or stories so occupied.

(c) Only metal framed windows glazed with one-quarter inch thick wire glass may be used in such partitions.

463. Dividing Walls—When Required.)

(a) Dividing walls will be required in buildings of Class I as follows:

(b) Every building of ordinary construction having a greater area than 9,000 square feet shall be divided into areas of 9,000 square feet or less by dividing walls; provided, however, that buildings of ordinary construction more than one story in height and having in addition to the requirements of this ordinance relating to buildings of ordinary construction with areas not greater than 9,000 square feet, a frontage on at least two public thoroughfares, and having all stairways and elevator shafts and other floor openings enclosed with brick masonry walls with all openings in same protected with approved automatic fire doors and all stair halls at street or ground level so constructed as to open directly or through a fireproof tunnel to a street or public alley and equipped throughout on all floors and basement with an automatic sprinkler system meeting with the approval of the Chief Fire Prevention Engineer may be built with an area of 12,000 square feet but if of greater area shall be divided into areas of 12,000 square feet or less by dividing walls.

(c) Every building of slow-burning or mill construction more than one story in height having greater area than 12,000 square feet, shall be divided into areas of 12,000 square feet or less by dividing walls; provided, however, that buildings of slow-burning or mill construction more than one story in height and having in addition to the requirements of this ordinance relating to buildings of slow-burning and mill construction having areas not greater than 12,000 square feet, a frontage on at least two public thoroughfares, and having all stairways and elevator shafts and other floor openings enclosed with brick masonry walls with all openings in same protected with approved automatic fire doors and all stairhalls at street or ground level so constructed as to open directly or through a fireproof tunnel to a street or public alley and equipped throughout on all floors and basement with an automatic sprinkler system meeting with the approval of the Chief of Fire Prevention and Public Safety, may be built of an area of 16,000 square feet, if of greater area shall be divided into areas of 16,000 square feet or less by dividing walls.

(d) Every fireproof building more than two stories in height and having greater area than 30,000 square feet, shall be divided into areas of 30,000 square feet or less by dividing walls.

(e) Where dividing walls are required in any of the above mentioned buildings, such building shall be subdivided by brick walls, built of the thickness given in the table for the thickness of enclosing walls and all doors or other openings in such walls shall have at each side of the same, iron

doors, tin clad doors or shutters, as described in Section 789 of this chapter, and said buildings as subdivided shall be provided with stairs and fire escapes the same as hereinafter required; provided, however, that one-story buildings of ordinary mill or slow-burning construction and two-story buildings of fireproof construction of any size when used as one store, room or workshop and occupied by only one person, firm or corporation, may be erected without any dividing walls.

464. Display of Placard—Indicating Floor Strength—Fee.) (a) It shall be the duty of the owner of every building of Class I now in existence or hereafter erected, or of his agent, or of the occupant, or person in possession, charge or control of same, to affix and display conspicuously on each floor of such building, a placard, stating the uniformly distributed load per square foot of floor surface, which may with safety be applied to that particular floor, as provided by this chapter, or if the strength of different parts of any floor varies, then there shall be such placards for each varying part of such floor. It shall be unlawful to load any such floors or any part thereof to a greater extent than the loads indicated upon such placards.

(b) It shall be the duty of the occupants of such buildings to maintain such placards during their occupation of the premises and it shall be the duty of the owners of buildings, or their agents, to cause the same to be properly affixed with each change of occupation. It shall be the duty of the owner, agent or lessee of each such building, now in existence, or hereafter erected, to procure and submit evidence of the correctness of the figures on such placards to the Commissioner of Buildings. Whenever such evidence as to the correctness of the figures shall be satisfactory to the Commissioner of Buildings, he shall approve such placards. Such placards so approved by the Commissioner of Buildings shall then be affixed upon the respective floors of the different buildings. The calculations and loads shall be in accordance with the provisions of this chapter.

(c) It shall be the duty of the owner, agent or lessee to pay to the City Collector a fee amounting to five dollars for each ten thousand square feet of floor area or less, for more than ten thousand square feet of floor area and not to exceed fifty thousand square feet of floor area ten dollars, for each additional fifty thousand square feet of floor area in excess of the first fifty thousand square feet of floor area ten dollars additional, and for issuing new placards in place of lost placards, the fee shall be for ten thousand square feet or less two dollars; for more than ten thousand square feet, five dollars. For the purpose of determining the amount of the fee herein required to be paid, every part of a structure separated by dividing walls as required by Section 463 of this chapter shall be considered as a separate building.

465. Live Loads for Floors.) The floors of all buildings of Class I hereafter erected shall be designed and constructed in such a manner as to be capable of bearing, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface, and the strength of such building shall be increased above the capacity to carry such a live load of one hundred pounds per square foot of floor surface, when the uses to which such building, or part thereof, is to be applied, involve greater stress. The calculations and loads shall be in accordance with the provisions of this chapter. In every building of Class I now constructed and in use, whenever it shall be found by the Commissioner of Buildings that the floors of same, or any part or parts thereof, are not capable of bearing, in addition to the weight of the floor construction,

partitions, permanent fixtures and mechanisms that may be upon the same, a live load of forty pounds for every square foot of surface, he shall condemn the same and order such floor or floors to be repaired or reconstructed within a reasonable time by the owner or occupant thereof, and shall proceed in the manner prescribed in sections 402 and 403 of this chapter, and in such case it shall be unlawful for the owner or occupant to continue to use such building until the said floors shall be repaired or reconstructed in accordance herewith.

466. Elevator Buildings.) Elevator buildings intended solely for the receipt, storage and delivery of grain in bulk, shall be of fireproof construction as described in this chapter.

ARTICLE V.

Class II.

467. Class II Defined.) (a) In Class II shall be included every building referred to in subdivisions herein designated as Class IIa, Class IIb and Class IIc.

(b) In Class IIa shall be included every building used for office purposes, and also every building used for clubhouse purposes where sleeping accommodations are provided for less than twenty persons.

(c) In Class IIb shall be included every building used for hotel, club, lodging or rooming house purposes where such building has sleeping accommodations for twenty or more persons.

(d) In Class IIc shall be included every building used for a hospital where sleeping accommodations for more than ten persons are provided in such building, and every building used for a home, day nursery or asylum where any such building shall have accommodations for more than twenty persons or where more than ten bedridden or decrepit persons are housed, and every building used for a jail, house of correction or detention.

468. Must Comply with General and Special Provisions.) Every building of Class II shall comply with the general provisions of this chapter, and in addition to the general provisions shall comply with the following special provisions:

469. Load Bearing Capacity of Floors in Buildings of Class II—Doors and Door Openings, Requirements for.) (a) For all buildings of Class II the floors shall be designed and constructed in such a manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of fifty pounds per square foot of surface, and such floor bearing capacity shall be computed in accordance with the provisions of this chapter.

(b) The aggregate width of door openings at, or approximately at the street level in buildings of Class II shall be equal to the aggregate width of stairways as specified in Sections 878, 879 and 880 of this chapter for buildings of Class II. Revolving doors may be installed in door openings of any building of Class IIa and Class IIb where the revolving wings of such revolving doors are so arranged that, by the application of a force more than is necessary to revolve said doors and which one person of ordinary strength is capable of exerting, all the wings of said door fold flat on each other and in an outward direction, or unless the revolving wings of said revolving doors are so arranged that they may be readily collapsed or removed by pressure or simple mechanical means, to be approved by the Commissioner of Buildings, and leave sufficient opening for two or more persons to pass through with a minimum width of not less than twenty-two inches on each side of said collapsed doors.

Where revolving doors are used as exits they shall be credited as exits only to the extent of the clear space remaining when the

doors are collapsed, and all deficiency of required exits must be made up by additional doors.

470. **Windows and Mechanical Ventilation.** (a) In every building hereafter erected for or converted to the purposes of this class, courts shall be of the minimum widths and areas prescribed in Section 644 of this chapter, and vent shafts as defined in Section 634 of this chapter, shall be of the following minimum width and areas:

Height of Shaft.	Least Width in Feet.	Square Feet.
1 story	3	21
2 stories	3	22 1/2
3 stories	3	27
4 stories	3	36
5 stories	5	48
6 stories	6	72
7 stories	8	96
8 or more stories.....	8	120

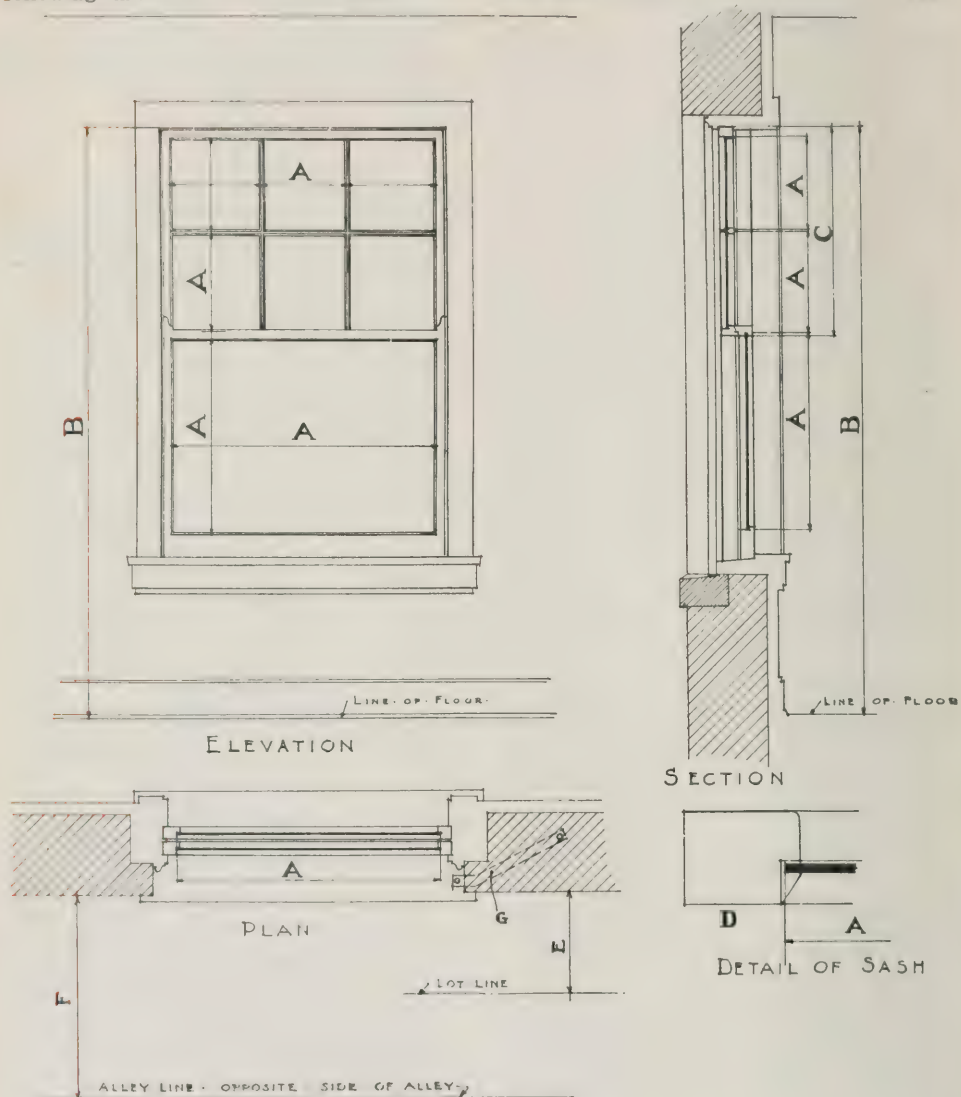


Fig. 2.
WINDOWS.

Sections 470b, 476, 488, 650, 677, 678, 784, 788.

- (A) Where measurement of glass is taken.
- (B) Top of window.
- (C) One-half of window.
- (D) Detail of sash showing where (A) is taken, under ordinary conditions.
- Area of glass would be (A x A).
- Total area would be summation of all (A x A).
- Windows to be constructed so that upper half (C) can be opened.
- (E) If E is less than 15 ft. wide, metal frames and wire glass to be used; and the glazed portion

of frames to be set with fire resisting glass, as provided in ordinance. (Sec. 784).

(F) If F is less than 30 ft., metal frames and wire glass to be used; and the glazed portion of frames to be set with fire resisting glass, as provided in ordinance. (Sec. 784).

For exceptions where steel rolling shutters, etc., are used see ordinance. (Sec. 784a).

(G) Provision made for safety device in cleaning of windows. (Sec. 788).

(b) In every building hereafter erected for or converted to the purposes of this class, every room used as a private sitting room or as a sleeping room, shall have at least one window which opens directly upon a street, alley, yard or court. The total glass area of such window or windows opening directly upon a street, alley, yard or court shall be not less than one-tenth of the floor area of such room. The top of at least one such window shall be at least seven feet above the floor and at least the upper half of such window shall be capable of being opened. No such window shall have a glass area of less than ten square feet unless it be a window in excess of the one-tenth of the floor area as required by this paragraph. Provided that sleeping cells in prisons, jails, police stations and houses of detention need not have each a window opening directly on a street, alley, yard or court if such cells are in a cell block which has windows with a glass area equal to one-fourth of the floor area of such block and arranged so that each window may be opened for one-half of its area, and provided further that such cell block and cells shall be equipped with a system of mechanical ventilation approved by the Commissioner of Health.

(c) In every building hereafter erected for or converted to the purposes of this class, every pantry, bath room and water closet and urinal compartment shall have at least one window which opens directly upon a street, alley, yard, court or vent shaft; the total glass area of such window or windows opening directly upon a street, alley, yard, court or vent shaft shall be not less than one-tenth of the floor area of such room or compartment. The top of at least one such window shall be at least seven feet above the floor and at least the upper half of such window shall be capable of being opened; and no such window shall have a glass area of less than six square feet or a glass width of less than one foot; provided, however, that such room or compartment, if located in the upper story of any such building, may be lighted and ventilated by means of a skylight having a glass area equal to one-tenth of the floor area of the room it serves and be equipped with an efficient ventilator or ventilators equal in effective area to one-twentieth of the floor area of such room; and provided further, that any such room or compartment in a building used for office, club, hospital or hotel purposes, in lieu of such window or windows, may be ventilated by an approved mechanical ventilation system which shall effect at least six complete changes of air per hour.

(d) In every building hereafter erected for or converted to office, hotel or club purposes, every room, except a room used as a bakery, which is below street grade and which is frequented by the public or in which there are regularly employed five or more persons, shall be ventilated by an approved mechanical ventilating system which shall effect at least six complete changes of air per hour; provided that in case of store rooms below street grade having 1,500 cubic feet of space per person employed therein two changes of air per hour will be deemed sufficient. In buildings of this class every room, either above or below grade, used as a bakery, shall comply with the provisions of the ordinances of the City of Chicago in respect to bakeries.

(e-1) In every building hereafter erected for or converted to the purposes of this class, every room not otherwise specifically provided for in this section where practicable, shall have a window or windows opening directly upon a street, alley, yard or court. The total area of such window or windows shall be not less than 10 per cent of the floor area, and at least one-half of each window shall be made to open.

(e-2) If the total area of the windows is less than one-tenth of the floor area, or if less than 50 per cent of the window is arranged to open, an approved mechanical ventilation supply system shall be installed for the excess floor area, fresh air being supplied at the rate of not less than one and two-tenths cubic feet per minute per square foot of floor area. The supply shall be taken from the outer air at an uncontaminated source through a screened opening at a point not less than 10 feet above street level, except that if an air washer or other cleansing medium, approved by the Commissioner of Health, is installed in connection with the system, the supply need not be taken from this height.

(f) It shall be the duty of the owner, agent, architect, or party in possession or control of any building in which a mechanical system of ventilation shall have been installed under the requirements of this section, upon completion of such system, to notify the Commissioner of Health in writing at least twenty-four hours in advance of the making of a test of such system; and each such system or unit shall be tested for volumetric efficiency by the owner or his representative in the presence of the representative of the Commissioner of Health and such system shall not be considered as meeting the requirements of this section until it shall have been approved by the Commissioner of Health. Every such mechanical ventilating system shall at all times be kept in good repair and in operation so as to insure the required ventilation of all rooms and compartments planned to be ventilated thereby, during all hours of human occupancy.

(g-2) If such reception room or anteroom is located between a corridor and another room or rooms, the partition separating such room from the adjoining room or rooms shall be equipped with transoms or openings (exclusive of doors), equivalent to five per cent of the area of the reception room or anteroom. The window or windows of the adjoining room or rooms shall open on a street, alley, yard or court and shall be at least 10 per cent of the combined floor area of the reception room or anterooms and adjoining room or rooms. The corridor partition separating reception room or anteroom from the corridor shall be equipped with transoms or openings (exclusive of doors), equal to at least two and one-half per cent of the floor area of the reception room or anteroom.

(g-3) If it is impracticable to ventilate any such reception room or anteroom, as aforesaid, such room shall be ventilated by an approved mechanical ventilation supply system which shall supply at least one and two-tenths cubic feet of air per minute per square foot of floor area in the reception room or anteroom. The supply shall be taken from the outer air at an uncontaminated source through a screened opening at a point not less than 10 feet above street level, except that if an air washer or other cleansing medium, approved by the Commissioner of Health, is installed in connection with the system, the supply need not be taken from this height.

(g-4) In all such anterooms or reception rooms in buildings of Class II-a, there shall be not less than 750 cubic feet of space for each person regularly employed therein.

Class IIa.

471. **Class IIa Defined.** In Class IIa shall be included every building used for office purposes, and also every building used for club house purposes where sleeping accommodations are provided for less than twenty persons.

472. **Buildings—Construction of—Height of.** (a) Buildings of Class IIa which are ninety feet or more in height shall be built entirely of fireproof construction.

(b) Buildings of Class IIa less than ninety feet and more than fifty feet in height shall be built either of slow-burning, mill or fireproof construction.

(c) Buildings of Class IIa not exceeding fifty feet in height may be built of ordinary construction.

Class IIb.

473. Class IIb Defined.) In Class IIb shall be included every building used for hotel, club, lodging or rooming house purposes where such building has sleeping accommodations for twenty or more persons.

474. Buildings—Construction of—Height of.) (a) Buildings of Class IIb more than five stories and basement high shall be of fireproof construction.

(b) Buildings of Class IIb more than three stories and basement high but not more than five stories and basement high shall be of slow-burning or fireproof construction. In case slow-burning construction be required the cellar and basement construction, including the floor construction of the first story above the cellar or basement, shall be of fireproof construction.

475. Walls—Divisions and Partitions—Fire Stops.) (a) In buildings hereafter erected used wholly, or in part for the purposes of Class IIb of ordinary, slow-burning or mill construction, there shall be for every eight rooms in any one story, dividing walls or partitions of incombustible material separating such eight rooms from the contiguous spaces.

(b) In all buildings hereafter erected to be used wholly or in part for the purposes of Class IIb, all elevators and stairs shall be enclosed in partitions of incombustible or fireproof material, and the partitions of all corridors leading to such elevators and stairs shall be of fireproof or incombustible material. Such partitions shall be carried on self-supporting masonry or a framework of steel or iron. Where glass is used in said partitions, the same shall be wired glass set in metal frames but such glass shall not exceed sixty per centum of the superficial area of said partitions.

(c) In all non-fireproof buildings of Class IIb there shall be between joists a stop of brick, concrete or tile not less than four inches in thickness, extending the full height of joists and spaced not more than twenty-five feet apart, measured in the direction of the length of the joist.

476. Sleeping Stalls in Rooms—When Allowed.) Sleeping stalls shall not be constructed or used in any room in any building now existing or hereafter erected and devoted, in whole or in part, to the purposes of a lodging or rooming house unless such room has two or more windows which open directly upon a street, alley, yard or court and which windows have a total area equal to at least one-tenth of the floor area of such room, nor unless the semi-partitions forming such stalls are so constructed that there is a clear and unobstructed interval of at least thirty inches between the top of such semi-partitions and the ceiling of the room, nor unless each such stall shall open directly into an aisle or passageway leading directly to a stairway or stairway fire escape, the location of which is indicated by a red sign and at night by a red light also. Such sleeping stalls shall not be installed in any such room in such numbers that there shall be less than 400 cubic feet of air per person when all stalls are occupied to their full capacity. The semi-partitions forming such stalls hereafter constructed shall be of incombustible material.

(See Illustration Sec. 470b.

Class IIc.

477. Class IIc Defined.) In Class IIc shall be included every building used for a

hospital where sleeping accommodations for more than ten persons are provided in such building and every building used for a home, day nursery or asylum where any such building shall have accommodations for more than twenty persons or where more than ten bedridden or decrepit persons are housed, and every building used for a jail, house of correction or detention.

478. Buildings—Construction of—Height of.) (a) All buildings of Class IIc not more than two stories and basement in height may be of ordinary, mill, or slow-burning construction.

(b) All buildings of Class IIc more than two stories and basement in height shall be of fire-proof construction.

479. Frontage Consents for Hospitals.) It shall be unlawful for any person, firm or corporation to build, construct, maintain, conduct or manage any hospital in any block in which two-thirds of the buildings fronting on both sides of the street or streets on which the proposed hospital may front are devoted to exclusive residence purposes, unless the owners of a majority of the frontage in such block and the owners of a majority of the frontage on the opposite side or sides of the street or streets on which said building fronts and faces consent in writing to the building, constructing or maintaining, managing or conducting of any such hospital in said block. Such written consents of the majority of said property owners shall be filed with the Commissioner of Health before a permit shall be granted for the building or constructing, or a license be issued for the maintaining, conducting or managing of any such hospital.

480. Coves in Rooms and Corridors of Hospitals.) In every building hereafter constructed for or converted to hospital purposes, in all corridors and rooms used by patients, all intersections of walls, floors and ceilings shall be formed with tangent coves.

481. Elevators in Hospitals.) Every building over three stories in height hereafter constructed for or converted to hospital purposes shall have at least one elevator, the floor dimensions of which shall be not less than seven feet by five feet, and said elevator shall be enclosed in a fireproof shaft with incombustible doors closing off each opening and shall comply with all the general provisions of this chapter.

482. Fire Escapes, Balconies, Platforms.) All buildings of Class IIc shall be equipped with stairway fire escapes not less than three feet in width which shall, in number, location and structural features, comply with the general provisions of this chapter relating to fire escapes. The balconies and platforms of such fire escapes shall be not less than three feet in width and may be made with a smooth surface of incombustible material laid flush with the floor and with a pitch of one-third inch to the foot.

ARTICLE VI.

Class III.

483. Class III Defined.) In Class III shall be included every building used as a private residence, also every building used for a hospital where sleeping accommodations for ten or less persons are provided in such building, and every building used for a home, day nursery or asylum where any such building shall have accommodations for twenty or less persons or where not more than ten bedridden or decrepit persons are housed, and also every building, structure or place with a ground area of less than five hundred square feet used as and for the purposes of a barn, stable or garage or for the housing or keeping of automobiles.

484. Must Comply With General and Special Provisions.) Every building of Class III shall comply with the provisions of this chapter, and, in addition to the general pro-

visions, shall comply with the following special provisions:

485. Buildings—Construction of—Height of—Space Occupied on Lot.) (a) Every building of Class III which is ninety feet or more in height shall be built entirely of fireproof construction.

(b) Every building of Class III less than ninety feet and more than fifty feet in height shall be built entirely of slow-burning, mill or fireproof construction.

(c) Every building of Class III less than fifty feet in height may be built of ordinary construction.

(d) The amount of space occupied on any lot by Class III buildings shall comply with the requirements of Section 642 of this chapter.

(e) Buildings used for garage purposes only, having a ground area of four hundred (400) square feet or less, may be built with enclosing walls and roof of corrugated iron or galvanized sheet steel supported on a frame of steel construction.

486. Skylights—Construction of—Glass in.) (a) The skylight on the roof of every building of Class III erected within the fire limits shall have its sides, sashes and frames constructed of metal or of metal-clad wood on all exterior surfaces.

(b) Such skylights shall be covered by a strong wire netting with mesh not more than one and one-half inches square placed not less than six inches above the glass, supported on uprights of incombustible material, unless wired glass is used.

487. Allowances of Live Loads in Construction of Floors.) In every building of Class III, the floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of the floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of 40 pounds for every square foot of surface.

488. Habitable Rooms—Definition of—Requirements as to Size and Ventilation.)

(a) For the purposes of this chapter the term "habitable room" shall be held to include every room in every building of Classes III and VI, and every room in buildings of other classes if such rooms are used for the purposes of Classes III and VI, in which a family or the individual members thereof regularly sleep or eat or carry on their usual domestic or social vocations or avocations. Laundries, bath rooms, water closet compartments, serving and storage pantries, storage rooms and closets, boiler and machinery rooms, cellars, corridors, and similar spaces used neither frequently nor during extended periods, shall not be deemed as coming within the scope of this term.

(b) In every building hereafter erected for or converted to the purposes of Class III, every habitable room shall have a window or windows with a total glass area equal to at least one-tenth of its floor area, opening onto a street, alley, or yard, as defined in Section 634 of this chapter; provided, that there shall be a space of at least three feet between the building and the lot line on one side, and a space of at least one foot between the building and the lot line on the other side. None of such required windows shall have a glass area of less than ten square feet; and each such window shall have its top not less than seven feet above the floor and shall be so constructed that at least its upper half may be opened its full width. No such habitable room shall have a floor area of less than eighty square feet, nor a clear height from floor to ceiling of less than eight feet and six inches; provided that attic rooms need not be eight feet six inches high for more than one-half of their area, and provided further that such attic rooms shall have total cubic contents of not less than seven hundred and fifty cubic feet each.

(c) No living room shall be partitioned off or constructed in any existing building or portion thereof, until plans of such building and room have been filed with, and a permit for such partitioning or constructing obtained from the Commissioner of Buildings and the Commissioner of Health; and every room so partitioned off or constructed shall comply with all the requirements for habitable rooms as contained in this section. (See Illustration Sec. 470b).

489. Alcoves.) Every alcove and alcove room shall comply with the requirements of Section 648 of this chapter.

490. Pantries, Bath Rooms, Water Closet and Urinal Compartments—Requirements in Relation Thereto.) In every building hereafter erected for or converted to the purposes of Class III, every pantry, bath room, water closet or urinal compartment shall have at least one window with a glass area of at least six square feet and a minimum width of at least one foot opening upon a street, alley, or yard as defined in Section 634 of this chapter, or upon a vent shaft not less in area than said window; and no habitable room shall open into or connect with a vent shaft thus used.

491. Bay Windows and Light Shafts—Materials For.) Bay or oriel windows may be built of combustible material on front or rear elevations of buildings of Class III of two stories or less in height, within the fire limits, provided such bay and oriel windows shall not have a greater width than twelve feet at the wall line of the building, and, provided, that the outside walls, roofs and soffits of such bay or oriel windows, when so constructed, shall be covered with sheet metal or other incombustible material. Light shafts wholly within the walls of a two-story building of Class III may be built of combustible material covered with sheet metal or other incombustible material. In all other cases, bay and oriel windows and light shafts and their supports shall be constructed entirely of incombustible material.

492. Walls—Brick Walls Upon Wooden Sills—Level of Sills Allowed.) Every building of Class III not exceeding one story or twenty feet in height from top of sills to the highest point of the roof, and with the side walls not exceeding fourteen feet in height, and with floor area not exceeding twelve hundred square feet, may have brick walls not less than eight inches in thickness erected upon wooden sills, the sills supported on iron, masonry, or concrete supports extending four feet below the surface of the ground, provided that the portion of the supports above the ground may consist of cypress or cedar posts. The foundations under such supports shall be of concrete, stone or brick, each covering not less than five square feet area and not more than eight feet apart, to support with safety the weight that may rest upon them; sills shall be placed not higher than four feet above the established grade of the street upon which the lot fronts and upon which lot the building is erected, where grades are established, and not exceeding seven feet above the ground where grades are not established. Every building more than one story and less than two stories high, having a gable or hip roof with a rise of not more than thirty degrees, may have eight-inch walls of solid brick or stone masonry, provided the side walls do not exceed fourteen feet in height measured from the first floor joist, and provided such building has a floor area not exceeding 1,200 feet and is not over 22 feet in width.

493. Stairways in Buildings of Class III Three Stories or More in Height.) (a) In every building of Class III hereafter erected, and three stories or more in height, there shall be either two stairways from the

first to the top story or one such stairway and a stairway fire escape.

(b) In every building of Class III now in existence, and three stories or more in height with a floor area of 1,000 square feet above the second floor, which is not equipped with two stairways or with one stairway and a stairway fire escape, safe and adequate means of egress from all floors shall be provided by the erection of additional stairways or stairway fire escapes, or such other means as in the judgment of the Commissioner of Buildings are required for the safety of the occupants of such building or the public.

(c) In every building of Class III now in existence or hereafter erected used for hospital, home, day nursery or asylum purposes there shall be provided at least two stairways located as far apart as practicable and extending from the top story to the ground. A separate door exit shall be provided for each stairway to the outside of the building.

ARTICLE VII.

Class IV.

494. **Class IV Defined.)** (a) In Class to in subdivisions herein designated as Class IVa, Class IVb, Class IVc and Class IVd, as follows:

(b) In Class IVa shall be included every building used as a church or place of worship.

(c) In Class IVb shall be included every building having a parish hall, lodge hall, dance hall, banquet hall, skating rink, assembly hall, halls used for the purpose of exposition and exhibition, and buildings having a hall for the purpose of instruction, other than schools, included in Class VIII, and also every existing building having a hall used for theatrical purposes at the time of the passage of this ordinance, except such buildings as are included in Classes IVa, IVc, IVd, and V.

(d) Class IVc shall include every building hereafter erected used for moving picture and vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, and where the seating capacity does not exceed three hundred; provided, that every building of Class IVc existing at the time of the passage of this ordinance shall comply with the provisions of Class IVb.

(e) In Class IVd shall be included every grandstand and every baseball, athletic and amusement park.

(f) In Class IVe shall be included every building hereafter erected having an arena, amphitheater or enclosed stadium for the purpose of exposition and exhibition where the seating capacity of such building shall exceed 40,000 persons. Where any building coming under this class has a seating capacity of less than 40,000 persons it shall be built to conform to the provisions of Class IVb.

495. **Must Comply With General and Special Provisions.)** Every building or structure of Class IV shall comply with the general provisions of this chapter and shall, in addition, comply with the following special provisions:

496. **Must Comply With All Ordinances.)** It shall be unlawful for any person, firm or corporation to construct or alter any Class IV building except in conformity with the ordinances of the City of Chicago relative thereto, or to operate any Class IV building that does not conform thereto.

497. **City Officials Empowered to Enter.)** The Commissioner of Buildings, Commissioner of Health, Commissioner of Gas and Electricity, Fire Commissioner, Chief Fire Prevention Engineer, Superintendent of Police, and their respective assistants, shall have the right to enter any build-

ing used in whole or in part for the purposes of Class IV at any reasonable time, and at any time when occupied by the public, in order to examine such building, and it shall be unlawful for any person to interfere with them in the performance of their duties.

498. **City Officials Empowered to Close.)** The Commissioner of Buildings, Commissioner of Health, Fire Commissioner, Chief Fire Prevention Engineer, Commissioner of Gas and Electricity, Superintendent of Police, or any one of them, shall have the power, and it shall be their joint and several duty, to order any building used wholly or in part for the purposes of Class IV, to be closed, where it is discovered that there is any violation of any of the provisions of this chapter, and kept closed until the same are complied with.

499. **Theaters in Frame Buildings Prohibited.)** No frame building or part thereof shall be used as a moving picture, vaudeville or other theatre.

500. **Buildings — Height — Construction — When Used in Part as Class IV.)** Every building higher than sixty feet, used in whole or in part for the purposes of Class IV or connected with or made part of any building so used, shall be entirely of fireproof construction. Every such building less than sixty feet in height shall be made of fireproof, slow-burning or mill construction, except as provided in this chapter.

CLASS IVa

501. **Class IVa Defined.)** In Class IVa shall be included every building used as a church or place of worship.

502. **Frontage—Seating Less Than Eight Hundred.)** Every building of Class IVa hereafter erected containing an aggregate seating capacity of 800 persons or less, shall have for the auditorium a frontage upon two open spaces, of which at least one shall be a street, and the other, if not a street, shall be a public or private alley, not less than ten feet wide, opening directly on a public street or alley.

503. **Frontage—Seating Over Eight Hundred.)** Every building of Class IVa hereafter erected containing an aggregate seating capacity greater than eight hundred persons, shall have a frontage upon three open spaces of which at least one shall be a public street and the others, if not streets, shall be public or private alleys of a width of not less than ten feet each, opening directly on a public street or alley, with at least one exit into each open space.

504. **Construction of.)** Every building of Class IVa, which has a seating capacity of less than 600 may be built of ordinary construction. Every building Class IVa having a seating capacity of more than 600 and less than 1,800 shall be built of slow-burning mill or fireproof construction.

505. **Fireproof Construction Necessary When.)** Every building of Class IVa having an aggregate seating capacity greater than 1,800 persons shall be built of fireproof construction.

506. **Limitations of Floor Level in Class IVa—Height Above Sidewalk.)** (a) The limitations of floor levels in buildings hereafter erected, occupied either wholly or in part for the purposes of Class IVa, shall be as follows:

(b) No auditorium of a greater seating capacity than 1,000, shall have the highest part of its main floor at a greater distance than 10 feet above the adjacent sidewalk grade. No room or rooms having a greater seating capacity than five hundred shall be at a greater distance above the sidewalk grade than twenty feet. No room or rooms used for the purposes of Class IVa having a greater seating capacity than two hundred

shall be at a higher level above the sidewalk grade than thirty feet; provided, however, that in the case of a building used either wholly or in part for the purposes of Class IVa, and built of fireproof construction, a room or rooms to be used for the purposes of Class IVa and of an aggregate seating capacity of less than five hundred may be located in any story thereof, but in such case, there shall be at least two separate and distinct flights of stairs from the floor or floors in which such room or rooms are located, to the ground, each of which stairs shall be not less than 4 feet wide in the clear and shall be equipped with emergency exits and not less than one stairway fire escape.

507. Emergency for Live Loads in Construction of Floors in Buildings of Class IVa—Stairways—Width of Entrances and Exits.) Every floor in buildings of Class IVa shall be designed and constructed in such a manner as to be capable of bearing in all its parts, in addition to the weight of floor construction, partitions, and permanent fixtures that may be set upon same, a live load of 100 pounds for every square foot of surface on such floor. The width of stairways in buildings of this class shall be twenty inches for every one hundred of the aggregate seating capacity, and for fractional parts of one hundred seating capacity, a proportionate part of twenty inches shall be added to the width of such stairway, but no stairway in such building shall be less than four feet wide in the clear, except as hereinafter provided, and provided that in any such building having a gallery, the seating capacity of which does not exceed two hundred and fifty persons, two separate and distinct stairways, each not less than three feet wide, shall be permitted.

508. Galleries—Exit and Entrance.) Distinct and separate exits shall be provided for each gallery. A common place of exit and entrance may serve for the main floor of the auditorium and the gallery or galleries, provided its capacity be equal to the aggregate capacity of all aisles or corridors leading from the main floor and such gallery or galleries to such place of exit or entrance. Not more than two galleries, placed one above the other, shall be permitted in any building of Class IVa.

509. Width of Aisles—Steps in Aisles.) Aisles in buildings of Class IVa shall, in the aggregate, be eighteen inches in width for each 100 of the seating capacity of the auditorium, and for fractional parts of 100 a proportionate part of 18 inches shall be added, but no aisle shall be less than two feet six inches in width in its narrowest part. Steps shall be permitted in aisles only as extending from bank to bank of seats, and whenever the rise from bank to bank of seats is less than 5 inches, the floor of the aisles shall be made on an inclined plane; and where steps occur in outside aisles or corridors, they shall not be isolated, but shall be grouped together, and there shall be a light so placed as to illuminate such steps in such outside aisles or corridors.

510. Corridors, Passageways, Hallways and Doors—Width of.) The width of corridors, passageways, hallways and doors, adjacent to, connected with, or a part of the auditorium, shall be computed in the same manner as is herein provided for stairways and aisles, excepting, however, that no such corridor, passageway or hallway shall be less than four feet in width, and no such doorway shall be less than three feet in width.

511. Seats, Number of, in Rows.) There shall not be more than fourteen seats in any one row between aisles. Rows of seats shall not be less than two feet eight inches from back to back, and no bank of seats shall be of greater rise than twenty inches.

512. Emergency Exits—All Doors to Open Outward.) (a) Emergency exits and outside stairways shall be provided for every building of Class IVa, which has a larger seating capacity than 800. Such emergency exits shall be one-half the aggregate width of the main exits, but no such emergency exits shall be less than three feet in width. Provided, that such stairways may be built inside the walls of the building in a corridor or passageway not less than seven feet wide and enclosed by a fireproof partition not less than four inches thick. Such stairway shall be of fireproof construction. All emergency exits and stairways therefrom shall be kept free from obstructions of any kind including snow and ice.

(b) All doors affording egress, directly or indirectly from the auditorium to a street or alley, shall open outward. Exit doors shall not be obscured by draperies and shall not be locked or fastened in any manner during the time that the building is occupied, and shall be so constructed and maintained that they may be easily opened from within.

513. Buildings in Which Seats are Not Fixed—Seating Capacity.) In computing the seating capacity of any room or building used for the purposes of this class in which the seats are not fixed, an allowance of six square feet of floor area shall be made for each person, and all space between the walls or partitions of such room or building shall be measured in this computation. Provided that in buildings of Class IVa standing at least seven feet from any other building and not having more than two stories and each floor having its own separate exits, the seating capacity of such floor shall be estimated alone as determining the kind of construction under this article.

514. Lighting Service Requirement.) Gas or electricity or both may be used for illuminating purposes in buildings of Class IVa. Provisions shall be made to properly light every portion of a building of Class IVa and every outlet therefrom leading to the outside of the building, and all open courts, passageways and emergency exits. Lights in vestibules, halls, corridors, passageways, stairways and other means of egress from the building and premises shall be on an independent system or circuit or service and shall be controlled separately and exclusively by a switch or a shutoff located near the main entrance. In rooms, halls and auditoriums used for the purpose of Class IVa provisions shall be made to furnish a light above, if possible, otherwise closely adjoining every opening to an exit or emergency exit from the room, hall or auditorium. Where the capacity of the room, hall or auditorium is 400 or less provisions shall be made to supply such light with either gas or electricity. Where the capacity of the room, hall or auditorium is greater than 400 provisions shall be made to supply such light by gas only.

Class IVb.

515. Class IVb Defined.) In Class IVb shall be included every building having a parish hall, lodge hall, dance hall, banquet hall, skating rink, assembly hall, halls used for the purpose of exposition and exhibition, and buildings having a hall for the purpose of instruction, other than schools, included in Class VIII, and also every existing building having a hall used for theatrical purposes at the time of the passage of this ordinance, except such buildings as are included in Classes IVa, IVc, IVd, IVe and V.

516. Frontage—Seating Eight Hundred or Less—Seating More than Eight Hundred.) (a) Every building of Class IVb, containing a hall or halls of an aggregate seating capacity of 800 persons or less,

shall have a frontage upon two public spaces, of which at least one shall be a street, and the other, if not a street, shall be a public or private alley, not less than ten feet wide, opening directly on a public street or alley.

(b) Buildings of Class IVb, containing halls or rooms, used for the purpose of Class IVb, of greater aggregate seating capacity than 800, shall have a frontage upon three open spaces, of which at least one shall be a public street, while the other two, if not streets, shall be public or private alleys, of a width of not less than ten feet, each opening directly on a public street or alley; provided that a fireproof passageway at grade level, and not less than seven feet in width may be used in place of one such alley, if such passageway connects with a public thoroughfare.

517. Auxiliary Buildings—Height and Construction of—Communicating Doors.)

(a) Every building hereafter erected and connected with or made part of any building used in whole or in part for the purposes of Class IVb, shall, if sixty or less feet in height, be of fireproof, mill or slow-burning construction, except as otherwise provided in this chapter, and, if more than sixty feet in height, of fireproof construction.

(b) No existing building, other than of fireproof construction, shall be connected to any building of Class IVb now existing or hereafter constructed, unless there is, between such buildings, a fire wall constructed as required by Section 732 of this chapter and extending from the ground to and through the roof.

(c) In all such cases where both buildings are not of fireproof construction, each opening in the intervening walls shall be equipped with automatic double fire-doors as required by Section 789 of this chapter.

518. Existing Buildings—Used for Class IVb and for Other Purposes.) No part of an existing building, other than of fireproof construction shall be used for the purposes of Class IVb unless such part is separated from all portions of the same building used for other purposes by a fire wall constructed as required by Section 732 of this chapter and extending from the ground to the roof and unless all openings in such fire wall are equipped with automatic double fire doors as required by Section 789 of this chapter; in which case such other portions may be constructed in the manner permitted for separate buildings of such class.

519. Construction—Depending on Capacity.) Every building used for the purpose of Class IVb, hereafter erected, containing a hall or room of an aggregate seating capacity of not more than 1,500 persons, shall be built of mill, slow-burning or fireproof construction. Every building hereafter erected to be used for theatrical purposes with a seating capacity greater than three hundred shall be built to conform to the requirements of buildings of Class V hereafter erected. If a hall or room or halls or rooms have a total seating capacity of more than 1,500 persons, such building shall be built of fireproof construction; provided, that buildings mainly used for exposition or exhibition purposes, and not used for theatrical purposes, and not exceeding two stories in height which have for public use only a main floor and one gallery and which have their walls and structural members of incombustible material and which comply with the provisions of this ordinance as to stairways, exits and fire escapes, may have their temporary seats, boxes, show cases, platforms, or booths, constructed of combustible material; provided, however, that any and all draperies, buntings, or other inflammable decorations shall be treated with a fire-retarding solution, subject to the

approval of the Chief Fire Prevention Engineer.

520. Buildings in Which Seats Are Not Fixed—Seating Capacity.) In computing the seating capacity of any room or building used for the purposes of this Class, in which the seats are not fixed, an allowance of six square feet of floor area shall be made for each person, and all space between the walls or partitions of such room or building shall be measured in this computation. Provided, that in buildings of Class IVb standing at least seven feet from any other building and, not having more than two stories and each floor having its own separate exits, the seating capacity of each floor shall be estimated alone as determining the kind of construction under this article.

521. Limitations of Floor Levels—Height Above Sidewalks—Skating Rinks.)

(a) The limitations of floor levels in buildings hereafter erected, occupied either wholly or in part for the purposes of Class IVb, other than skating rinks, shall be as follows: No auditorium of a greater seating capacity than one thousand shall have the highest part of its main floor at a greater distance than fourteen feet above the adjacent sidewalk grade. No room or rooms having a greater seating capacity than five hundred shall be at a greater distance above the sidewalk grade than twenty feet. No room or rooms used for the purposes of Class IVb having a greater seating capacity than two hundred shall be at a higher level above the sidewalk grade than thirty feet; provided, however, that in the case of a building used either wholly or in part for the purposes of Class IVb and built of fireproof construction, a room or rooms to be used for the purposes of Class IVb and of an aggregate seating capacity of less than five hundred may be located in any story thereof, but in such case, there shall be at least two separate and distinct flights of stairs from the floor or floors in which such room or rooms are located, to the ground, each of which stairs shall be not less than four feet wide in the clear and such floor or floors shall be equipped with emergency exits and have not less than one stairway fire escape.

(b) In buildings of fireproof construction hereafter erected, banquet halls, ballroom halls, or society halls having a seating capacity of not more than 900 and lodge halls having an aggregate seating capacity of not more than 900 may be located on any floor. Such banquet halls, ballroom halls, society halls and lodge halls shall have access to at least two interior stairways and not less than one stairway fire escape, the combined width of which shall be equal to at least eighteen (18) inches for each 100 persons for whom accommodations are provided in said banquet halls, ballrooms, society halls, or lodge halls.

In buildings of fireproof construction hereafter erected, banquet halls, lodge halls, society halls or drill halls used for lodge purposes, having a seating capacity of not more than 1800, may be located on any floor eighty feet or more above the adjacent sidewalk grade, where all parts of said building above such height are used exclusively for lodge or society purposes. Such banquet halls, lodge halls, society halls, or drill halls shall have access to at least four interior stairways, and not less than four stairway fire escapes, the combined width of which shall be equal to at least eighteen inches for each 100 persons for whom accommodations are provided in said banquet halls, lodge halls, society halls, or drill halls. Where an interior stairway in such a building is enclosed in a tower and built as required by the provisions of Section 881, paragraph (b) of this chapter, then such stairway shall be considered the equivalent in "Width of Stairs" of two open stairways, or an open stairway and a fire escape. Drill halls used for lodge purposes, having a main floor seating capacity of not more than 1800 may, in

addition, have a spectators' balcony having a seating capacity not to exceed 500. Such spectators' balcony shall have at least two interior stairways, not less than four feet wide, and at least two exterior fire escapes, not less than three feet wide, and shall be in accordance with provisions of Sections 524 to 529, both inclusive, of this chapter. Where adjoining buildings, or buildings on opposite sides of an open space, used for the same purposes, or for office purposes, and operated by the same persons, firm or corporation, are connected on each floor by enclosed fireproof bridges or passageways with fireproof doors at each end of bridge or passageway, or by fireproof vestibules with doors built and equipped as required by this chapter for dividing wall doors, then said bridge or passageway, or vestibule, may be considered to be equivalent to a stairway for each of the two areas.

(c) No room or hall used for the purposes of a skating rink shall be constructed, operated or maintained with its main floor level more than two feet above the inside sidewalk grade of the street upon which such building containing same fronts, or more than one foot above the ground level in front of such building when it does not face upon a street, or more than one foot below the inside sidewalk grade of the street upon which such building fronts, or more than one foot below the ground level in front of such building when it does not face upon a street.

522. Allowance for Loads in Construction of Floors.) All floors of all buildings of Class IVb shall be designed and constructed in such a manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floor, in accordance with the general provisions of this chapter.

523. Stairways—Entrances and Exits—Handrails—Width of.) The width of stairways in buildings used wholly or in part for the purposes of Class IVb, shall be 18 inches for every 100 persons of the aggregate seating capacity of all rooms used for the purposes of Class IVb in such buildings; but no stairway in such building shall be less than four feet wide in the clear; provided, that in any such building having a room or rooms, balcony or gallery, used for the purposes of Class IVb, the aggregate seating capacity of which does not exceed 250 persons, two separate and distinct stairways, each three feet wide, shall be permitted, but no such building hereafter erected shall have less than two interior stairways of the width required by this ordinance, and located as far apart as practicable. Every hall or room used for the purposes of Class IVb in a building hereafter erected, shall have access to not less than two stairways. Every stairway shall have handrails on each side thereof; stairways which are over seven feet wide shall have double intermediate handrails with end newel posts at least five and a half feet high; no stairway shall ascend a greater height than 13 feet 6 inches without a level landing, which landing shall be not less than four feet wide measured in the direction of the run of the stairs. Every stairway leading to a box or boxes shall be independent of all other stairs or seats; and such stairway shall not be less than 2 feet 6 inches wide in the clear when such box or boxes seat not to exceed thirty people, and an additional width of one inch shall be added to such stairway for each additional five persons for whom seating capacity is provided.

524. Balconies and Galleries—Designation of.) Where there are balconies or galleries, the first balcony or gallery shall be designated "balcony" and the second and third balconies or galleries shall be designated respectively "gallery" and "second gallery."

525. Balconies and Galleries—Exit and Entrance.) Distinct and separate places of exit and entrance shall be provided for each gallery. A common place of exit and entrance may serve for the main floor of the auditorium and the balcony, provided its capacity be equal to the aggregate required capacity of all aisles or corridors leading from the main floor and such balcony to such place of exit and entrance.

526. Aisles—Steps in Aisles—Passageways—Cross Aisles Leading to Emergency Exits.)

(a) Aisles in rooms used for the purposes of Class IVb shall have in the aggregate a width of 18 inches for each 100 of the seating capacity of such room, and for fractional parts of 100 a proportionate part of 18 inches shall be added; but no aisle shall be less than two feet six inches in width.

(b) Steps shall be permitted in aisles only as extending from bank to bank of seats, and whenever the rise from bank to bank of seats is less than five inches the floor of the aisles shall be made as an inclined plane, and where steps occur in outside aisles or corridors, they shall not be isolated, but shall be grouped together, and there shall be a light so placed as to illuminate such steps in such outside aisles or corridors.

527. Corridors, Passageways, Hallways and Doors—Width of.) The width of corridors, passageways, hallways and doors adjacent to, connected with or a part of such rooms, shall be computed in the same manner as is herein provided for stairways and aisles, excepting, however, that no such corridor, passageway or hallway shall be less than four feet in width, and no such door shall be less than three feet in width.

528. Seats—Number in Rows.) There shall be not more than fourteen seats in any one row between aisles, and in a room or rooms used for the purposes of Class IVb, of a seating capacity greater than 400 persons, there shall be an aisle on each side of any bank of seats, where there are over seven seats in a row. Rows of seats shall not be less than thirty-two inches from back to back and no bank of seats shall be of a greater rise than twenty inches.

529. Emergency Exits.) (a) Emergency exits and stairways shall be provided outside of any and all rooms used for the purposes of Class IVb which have a seating capacity larger than eight hundred, and such emergency exits shall have a width equal to one-half of the width provided for the main exits and such emergency exits shall lead directly to a public thoroughfare. Provided, however, that any room or rooms used for the purposes of Class IVb in any building hereafter erected, having a seating capacity of more than 400, shall have emergency exits outside of the walls of such building equal in width to one-half of the exits required for the main exits, and such emergency exits shall lead directly to a public thoroughfare. Doors leading to emergency exits shall not be less than three feet wide. Stairs shall not be less than four feet wide. Such emergency exits and stairways may be built inside the walls of such building of a width not less than four feet, provided that they are enclosed by a fireproof partition not less than 4 inches thick; and provided further, that the stairs themselves are constructed of incombustible material. Emergency stairways may descend into open spaces or passageways, provided they do not obstruct more than one-half of the width of such open spaces or passageways.

(b) Every stairway fire escape shall be located and constructed in accordance with the requirements of Sections 881, 882 and 885, but in no case shall any room used for the purposes of Class IVb located above the third story of any building have less than one stairway fire escape.

530. Doors to Open Outward.) All doors affording access directly or indirectly to the

street, alley or corridor from any room used for the purposes of Class IVb shall open outward.

531. Walls Between Auditorium and Stage.) There shall be a solid brick wall of the same thickness as required for outside walls between the auditorium and stage in buildings hereafter erected for or converted to the use of Class IVb and used either wholly or in part for that purpose; and in existing non-fireproof buildings such wall must extend to a height of three (3) feet above the roof. Provided, however, that in existing buildings any room used for the purposes of Class IVb on or before March 13, 1911 having a greater seating capacity than four hundred (400) shall have a proscenium wall built of masonry or incombustible material.

532. Curtain Shall Be of Iron, Steel or Asbestos—Inspection of—Fee.) The main curtain opening in any such room shall have a wrought iron or steel or three-ply asbestos curtain with a wire mesh imbedded therein, which shall be inspected by the Department of Building semi-annually, for which inspection a charge of five dollars shall be made, and all other openings in the proscenium wall shall have self-closing iron doors.

533. Structures Over Ceiling—Construction.) If any structure intended to be occupied by people is built over the ceiling of any room, used wholly or in part for the purposes of Class IVb, the girders or trusses supporting the same shall be of steel protected with fireproofing as required for interior columns in Section 839.

534. Standpipe and Hose on Stage.) In every room used for the purpose of Class IVb and having a seating capacity of 250 or more, and where scenery is used, a standpipe with hose connection and hose shall be installed on each side of the stage under the direction of the Chief Fire Prevention Engineer.

535. Vents of Flue Pipes.) (a) One or more vents of flue pipes of metal construction or other incombustible material approved by the Commissioner of Buildings shall be built over the stage, and shall extend not less than ten feet above the highest point of the roof, and shall be equivalent in area to one-twentieth of the area of the stage.

(b) In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls, and shall be continued and run up on the exterior of the building to a point five feet above the highest point of the additional stories.

(c) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a small tarred hempen cord and also by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches, or either of them, fail to operate. Such stations shall be located in such places on the stage as may be determined by the Fire Commissioner, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

536. Fuse Boxes.) Every fuse box shall be surrounded by two thicknesses of fireproof material with an air space between, and no fuse shall be exposed to the air between the switchboards; all electrical equipment in such rooms shall be installed and maintained to the satisfaction and ap-

proval of the Commissioner of Gas and Electricity.

537. Capacity—Certification for License.)

(a) The Commissioner of Buildings shall determine the number of persons which every room used for the purposes of Class IVb may accommodate according to the provisions of this chapter, and shall certify the same to the City Clerk.

(b) No amusement license shall be issued for any room used for the purposes of Class IVb until the Commissioner of Buildings shall first have certified, in writing, that such room complies with the provisions of this chapter in every respect.

538. Lighting Service Requirement. Gas or electricity or both may be used for illuminating purposes in buildings of Class IVb but the use of gas is prohibited in that part of the building known as the stage side of the proscenium wall. Provisions shall be made to properly light every portion of a building of Class IVb and every outlet therefrom leading to the outside of the building, and all open courts, passageways and emergency exits. Lights in vestibules, halls, corridors, passageways, stairways and other means of egress from the building and premises shall be on an independent system or circuit or service, and shall be controlled separately and exclusively by a switch or a shutoff located near the main entrance. In rooms, halls and auditoriums used for the purposes of Class IVb provisions shall be made to furnish a light above, if possible, otherwise closely adjoining every opening to an exit or emergency exit from the room, hall or auditorium. Where the capacity of the room, hall or auditorium is 400 or less provisions shall be made to supply such light with either gas or electricity. Where the capacity of the room, hall or auditorium is greater than 400 provisions shall be made to supply such light by gas only.

539. Scenery—Definition—Movable Scenery.) (a) "Scenery" as used in this chapter shall include all scenery, drop curtains and wings which are constructed or made of cloth, canvas or combustible material, whether stationary or movable.

"Movable scenery" shall include all scenery, drop curtains, borders and wings which are made movable for the purpose of changing scenery and substituting another set during or between the various stage acts.

540. Scenery to be Non-Inflammable.) All scenery or stage paraphernalia of any sort used upon the stage of any room used for the purpose of Class IVb shall, previous to such use, be treated with a fireproof solution and shall be tested and approved by the Chief Fire Prevention Engineer.

541. Amount of Scenery Allowed—Sprinkler System.) Two sets of house scenery and three drops, exclusive of asbestos fire curtain and picture screen shall be allowed in existing rooms used for theatrical purposes in buildings of Class IVb where the same are on the first floor level, or in a building of fireproof construction or which conformed with the requirements of fireproof buildings at the time same was erected, and the same shall also be allowed in such existing rooms used for theatrical purposes above the first floor level when the seating capacity of such room does not exceed 300. Such scenery shall be known and designated upon the licenses issued by the city as "Permanent House Scenery," and the use and moving of such scenery shall not be construed as placing said building, hall, room or theater within the provisions of the ordinance relating to Class V buildings.

A set of house scenery as contemplated by this section is hereby defined to mean sufficient scenery to make one stage setting, such scenery being in continuous use in such house; provided, however, that the low-

ering of a drop shall not constitute a new stage setting.

No other scenery except as above enumerated shall be permitted on, above or underneath the stage.

Every existing Class IVb theatre affected by this section shall be equipped with an approved sprinkler system and also with stand-pipe and hose subject to the approval of the Chief Fire Prevention Engineer.

No Class IVb theatre in existence on March 13, 1911 affected by this section shall increase its seating capacity beyond its capacity on July 22, 1912.

No scenery or stage paraphernalia of combustible materials shall be used on the stage of any room or theatre used for the purposes of Class IVb, unless such scenery and paraphernalia shall have been treated with a paint or chemical solution which shall make it non-inflammable, and all such treated scenery or stage paraphernalia, or both, shall be tested and approved by the Chief Fire Prevention Engineer.

542. Dressing Room Partitions.) Partitions forming dressing rooms, except where already built, shall be constructed of incombustible material, and such dressing room shall be properly ventilated, as in the judgment of the commissioner of health may be required.

CLASS IVc.

543. Class IVc Defined—Moving Picture and Vaudeville Shows—Seating Capacity.) Class IVc shall include every building hereafter erected used for moving picture or vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, and where the seating capacity does not exceed three hundred, provided that every building of Class IVc existing at the time the passage of the ordinance known as The Chicago Code of 1911 shall comply with the provisions of Class IVb. All buildings hereafter erected for moving picture and vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, with a seating capacity of over three hundred, and for the exhibition of moving pictures only, where the seating capacity is more than one thousand, shall be built to conform with the requirements for buildings of Class V hereafter erected as contained in this chapter. Buildings for the exhibition of moving pictures only and with a seating capacity of over three hundred, but not to exceed one thousand, shall also be built to conform with the requirements for buildings of Class V hereafter erected, in all their structural requirements and equipment except in so far as such requirements and equipment are modified in Sections 544 and 545 hereof.

544. Frontage of Class IVc—Frontage, Open Spaces and Fireproof Passageways of Moving Picture Theatres Containing a Seating Capacity of more Than Three Hundred.) Every room used for the purposes of Class IVc shall have a frontage upon at least two public thoroughfares, of which at least one shall be a street, and the other a street or a public or private alley not less than ten feet wide and opening directly on a public street or alley.

Buildings for the exhibition of moving pictures only, with a seating capacity of over three hundred but not to exceed one thousand, shall be located so that they adjoin at least two public thoroughfares, one of which shall be a public street and the other may be a public alley not less than ten feet in width. Except as hereinafter otherwise provided, the audience room of such building shall have either a public thoroughfare or an open space unobstructed from the ground to the sky on each side thereof. Such open space, when the audience room has a capacity not to exceed six hundred seats, shall be five feet wide, and six inches shall

be added to the width of same for every side additional one hundred seats in said audience room up to the maximum of one thousand seats. In all cases where there is a public alley in the rear of such building, said open space must connect directly with the alley. In case the entire audience is seated on the ground level said open spaces shall extend alongside of the audience room so as to connect with exit doors placed approximately in the middle of the audience room between the opposite ends of same. Where there is a balcony or gallery installed, such open spaces must extend along the entire length of the audience room so as to connect with exits from the balcony or gallery at their highest and lowest levels. Where such a building is located on a corner lot and adjoins a public street on one side and a public street or an alley not less than ten feet wide on two of the remaining sides and the building is so located that it adjoins such public thoroughfares on three sides for its entire extent, it shall not be necessary to construct an open space on the remaining side thereof, but in all such cases there shall be either an open space unobstructed from the ground to the sky or a fireproof passageway at least five feet wide leading from the side of the audience room not bordering on a street or other public space to the street in front of the theatre and another leading to the alley or other public space in the rear of the theatre. If the seating capacity of such theatre is over six hundred, six inches shall be added to the width of such open space or passageway for every one hundred seats or fraction thereof in excess of six hundred and up to the maximum of one thousand. If access to the street and alley or other public space as herein provided is by means of a fireproof passageway, such fireproof passageway must be constructed in all respects according to the provisions of Section 610 except as herein otherwise provided.

545. Construction.) Buildings of Class IVc hereafter erected, of a seating capacity not to exceed three hundred, shall not be built more than thirty feet in height and may be built of ordinary construction, but the enclosing walls shall be constructed of masonry. No moving picture, vaudeville or theatrical show shall hereafter be installed in a frame building. No room or hall used for the purposes of Class IVc shall hereafter be installed underneath any living or sleeping room.

Buildings for the exhibition of moving pictures only with a seating capacity of more than three hundred but not to exceed one thousand, when the same shall be located as provided for in Section 544 hereof, may be built as herein provided. Said buildings shall contain no stage, proscenium wall nor scenery of any description. The screen for the display of the pictures must be attached to the rear wall of the building, not to exceed six inches away from same. No decorative walls or paintings or other effects shall be constructed inside the audience room in such a manner as to allow any rooms or spaces between same and the enclosing walls of the building. An open platform not to exceed seventy-two square feet in area may be built before the picture screen in moving picture theaters having a seating capacity of not more than three hundred, and the said platform may have an additional twenty-four square feet in area for each additional one hundred in seating capacity in excess of three hundred. On the main floor of such building there shall be at least two main aisles with direct exits at front and rear and two cross aisles with direct exits from the side. When such building contains a balcony or gallery there shall be emergency exits from the highest and lowest levels of same on one side and on the other side there shall be either emergency exits or enclosed interior stairs from the

highest level of the balcony, and the lowest level of the balcony shall be connected with such side stairs by means of a tunnel. All seats in the audience room shall be at least twenty inches wide and space thirty-four inches from back to back. The booth for the moving picture machine must be of construction in conformity with the requirements for such machine booths in buildings of Class IVc; in all other respects such buildings shall comply both in structural requirements and equipment with the provisions of this chapter relating to theatres of Class V hereafter erected.

Provided, however, that where such building has no balcony or gallery and the seats in the audience room are all on the ground floor of same, and where no portion of the building connected with or made a part of or used in conjunction therewith exceeds two stories in height, and where the lobbies and entrances leading to such part of the building used for purposes of Class IVc have brick dividing walls separating them from the portions of the building connected therewith used for the purpose of any other class as defined in this ordinance, and the floors of said lobbies and entrances and the floors and ceilings above such lobbies and entrances are of fireproof construction and there are no doors or windows leading from such lobbies and entrances to any portion of the said building used for any other purpose than Class IVc, such portion of said building as is not used for purposes of Class IVc may be built in accordance with the provisions of this chapter designating the manner of construction for such classes.

546. Floor Levels—Limitations.) The following limitations of floor levels shall apply to every building used for the purposes of Class IVc; the highest part of the auditorium floor shall not exceed four feet above the sidewalk level. The floor level at the entrance shall not be at a greater height than eight inches above the sidewalk. The aisles shall not have a greater incline than 1½ inches to the foot.

547. Stairways—Handrails. Where external stairways are required, such stairways shall be at least six inches wider than the exits, and shall have treads not less than ten inches wide and risers not more than 8 inches high, and shall be provided with suitable handrails on each side thereof, and the width of such stairs shall comply with the requirements of Class IVb.

548. Balconies and Galleries.) In non-fireproof buildings hereafter erected for, or converted to the purposes of Class IVc, not more than one balcony and no galleries shall be constructed.

549. Width of Aisles—Steps in Aisles.) Aisles and rooms used for the purpose of Class IVc shall have in the aggregate a width of not less than twenty inches for each 100 of seating capacity of such room and for fractional parts of 100 a proportionate part of twenty inches shall be added, and no aisles shall have a width of less than two feet six inches. When side emergency exits are permitted, there shall be a cross aisle not less than three feet wide, leading directly to said exit. Steps shall not be permitted in any aisle or in any portion of the auditorium floor.

550. Corridors — Passageways — Doors — Width Of.) The width of corridors, passageways and doors shall be computed in the same manner as provided in Sections 526 and 527.

551. Seats—Size—Location.) There shall not be more than ten seats in any one row between aisles, nor more than six seats between an aisle and side wall. Seats shall not be less than thirty-two inches from back to back and shall not be less than twenty inches in width measured at the top of the seat back, and shall be secured firmly to the floor.

552. Doors and Exits.) In every building of Class IVc, there shall be provided at least two entrance doors. No entrance doors shall be less than four feet in width. If the rear of the building abuts upon an alley, there shall be provided not less than two emergency exits leading directly to the said alley. Wherever emergency exits pass over or under the stage floor level, they shall be enclosed with walls of masonry nine inches in thickness, or four-inch hollow tile, or of two-inch solid plaster, composed of iron studs and metal lath and plaster, and shall have floors and ceilings of slow-burning mill, or fireproof construction. If the side of the auditorium abuts upon a street or alley, such emergency exits shall be located as follows: one exit shall be located at a distance not greater than five feet from the proscenium wall or stage, and the other exit shall be located at a distance half way between the foyer and the stage wall. Exits by means of stairways or stairway fire escapes, equal in width to eighteen inches for each one hundred persons, shall be provided, and for fractional parts of one hundred, proportionate part of eighteen inches shall be added. No such exit shall be less than two feet six inches in width.

553. Doors to Open Outward.) All doors affording ingress or egress in buildings of Class IVc shall open outward, and no door shall be less than three feet wide. Such doors shall be so constructed that they may be easily opened from within.

554. Walls Between Auditorium and Stage.) Where the area of the stage exceeds 72 square feet, there shall be provided a proscenium wall of solid masonry of not less than nine inches in thickness, extending from ground to the roof. Where the stage area is less than 72 square feet its proscenium wall may be constructed of two-inch solid plaster walls, composed of metal studs and metal lath and plaster or three-inch hollow tile. In no case shall the underside of ceiling or roof over stage house behind proscenium wall be at a higher level than three feet over the highest point of main proscenium opening. And there shall be no trap doors or other openings in the stage floor.

555. Curtain.) (a) The main curtain in the opening of the proscenium wall shall be composed of long fibre asbestos twisted on brass wire and woven into a close cloth. The laps shall be sewed with two lines of brass and asbestos stitching, which laps shall not be less than one-inch wide. Said cloth shall be lapped at least four times around the top and around the bottom bars with at least three lines of the stitching above specified.

(b) The edge of the curtain shall be continuously reinforced by lapping and stitching and also with pieces of sheet metal for clips. The curtain shall be at least thirty inches wider and higher than the masonry opening, and shall have steel top and bottom bars of not less than two square inches in cross section which bars shall be connected by four three-sixteenth-inch steel cables.

(c) There shall be three-eighth-inch spanning cables with upper ends secured to steel brackets fastened to the wall and the lower ends sufficiently counter-weighted to keep the cables taut and where cables pass through the stage floor, the holes shall be metal bushed.

(d) The curtain shall have hard wood eyelets not over eighteen inches center to center, around the standing cables on both vertical edges, which eyelets shall be secured to the curtain by bent brass clips riveted to the curtain with double sheet metal reinforcing.

(e) There shall be steel lifting cables, one-half inch in diameter, at each end of the curtain and at intermediate points not over ten feet apart attached to drums on shafts located above the curtain.

(f) The operating machinery shall be built according to good mechanical engineering practice.

(g) There shall be emergency chains midway between the lifting cables, to hold the curtain which shall be equal in strength and efficiency to the lifting cables.

(h) There shall be steel guides of not less than three-eighth-inch metal on each side of the curtain from the stage floor to the level of the overhead sheaves. The metal guides shall lap the edges of the curtain not less than four inches. The curtain shall be incombustible in all its parts and its operating devices.

(i) The painting and the manner of tripping the curtain and the number of and the location of places for tripping shall be subject to the approval of the Chief Fire Prevention Engineer.

(j) A permit shall be obtained from the Department of Buildings for the erection of each such curtain. The Commissioner of Buildings shall inspect each such curtain semi-annually for which semi-annual inspection, a fee of \$5.00 shall be charged.

556. Other Openings in Stage Walls.) Every other opening in the proscenium wall or in the other walls of the stage shall have self-closing incombustible doors.

557. Structure Over Ceiling—Construction.) A structure may be built over the ceiling or roof of any building used wholly or in part for the purposes of Class IVc, provided such space is not used for sleeping or living purposes. Girders or trusses supporting same shall be of steel protected by fireproofing as required in Section 839 and the entire ceiling shall be covered with incombustible material subject to the approval of the Commissioner of Buildings.

558. Picture Machine Booth.) The walls floor and ceiling of every moving picture booth or machine house shall be built of four-inch hollow tile or four-inch solid concrete, supported on iron beams or columns, the door of operating room to be metal clad and swing outwards. There shall be a metal smoke or flue pipe eighteen inches in diameter extending from ceiling to three feet above roof of machine house and terminating in the open air outside of building.

559. Standpipes and Hose on Stage.) Where the stage area exceeds seventy-two square feet and any scenery is used on stage, there shall be a standpipe system installed on said stage subject to the approval of the Chief Fire Prevention Engineer.

560. Vent or Flue Pipe Over Stage.) (a) When the stage exceeds seventy-two square feet in area and combustible scenery is used, one or more flue pipes of incombustible material and equivalent to one-twentieth of the area of the stage shall be built over the stage and shall extend eight feet above the highest point of roof.

(b) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a small tarred hempen cord and also by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches or either of them, fail to operate. Such stations shall be located in such places on the stage as may be determined

by the Fire Commissioner, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

561. Capacity—Certification for License.) The Commissioner of Buildings shall determine the number of persons any room used for the purposes of Class IVc may accommodate according to the provisions of this chapter, and shall certify the same to the City Clerk.

562. Lighting Service Requirement.) Gas or electricity or both may be used for illuminating purposes in buildings of Class IVc but gas shall not be used in that part of the building known as the stage side of the proscenium wall. Provisions shall be made to properly light every portion of a building of Class IVc and every outlet therefrom leading to the outside of the building, and all open courts, passageways, and emergency exits. Lights in vestibules, halls, corridors, passageways, stairways and other means of egress from the building and premises shall be on an independent system or circuit or service, and shall be controlled separately and exclusively by a switch or a shutoff located near the main entrance. In rooms, halls or auditoriums used for the purposes of Class IVc provisions shall be made to furnish a light supplied by gas, above if possible, otherwise closely adjoining every opening to an exit or to an emergency exit from the room, hall or auditorium. Where the capacity of the room, hall or auditorium is greater than three hundred, provisions shall be made to furnish a light supplied by electricity and on the same circuit as the corridor and vestibule lights, above if possible, otherwise closely adjoining every opening to an exit or an emergency exit from such hall or auditorium, in addition to the gas light in such location previously required.

563. Lighting in Theaters—Test of Sufficient Light—Penalty.) Every portion of a moving picture theater, including exits, courts and corridors, devoted to the use or accommodation of the public shall be so lighted by electric light during all exhibitions and until the entire audience has left the premises that a person with normal eyesight shall be able to read Snellen standard test type 40 at a distance of twenty feet; and type 30 at a distance of ten feet; normal eyesight meaning ability to read 20 at a distance of twenty feet in daylight. Cards showing types 20, 30, and 40 should be displayed in the corridor of every such theater together with a copy of this ordinance. Any person, firm or corporation that violates, neglects or refuses to comply with, or resists or opposes the enforcement of this section, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense, and shall be deemed guilty of a separate offense for every day on which such violations, neglect or refusal shall continue.

564. Scenery Shall Be Stationary—Approval—Metal and Asbestos Scenery.) All scenery on the stage shall be made stationary, and shall consist of not over two asbestos curtains, three stationary wings on each side and four stationary border drops. All scenery and stage paraphernalia shall be treated with a fire-retarding solution subject to the test and approval of the Chief Fire Prevention Engineer. Where all scenery is made of metal upon metal supports, metal frames, and metal attachments or where all scenery is of pure long fibre asbestos twisted on brass wire and woven into a close cloth with metal framings, metal supports and metal attachments, it shall not be considered as scenery within the meaning of the term as used in this chapter.

565. Dressing Room Partitions.) Parti-

tions forming dressing rooms, except where already built, shall be constructed of incombustible material, and such dressing rooms shall be properly ventilated as in the judgment of the Commissioner of Health may be required.

566. Frontage Consents Required.) No building of this class shall hereafter be constructed for, or converted to the use of said class, unless frontage consents are secured as required by the ordinances of the City of Chicago and filed with the Commissioner of Buildings.

CLASS IVd

567. Class IVd Defined.) In Class IVd shall be included every grand stand and every baseball, athletic and amusement park.

568. Loads—Allowance for Live Loads.) The floors and stairs of grand stands and bleacher stands, existing or hereafter built, shall be designed and constructed in such manner as to be capable of bearing in all their parts and supports, in addition to the weight of the floor construction, partitions and permanent fixtures, that may be set upon the same, a live load of not less than one hundred pounds for every square foot of surface of said floors, and a live load of not less than one hundred and fifty pounds for every square foot of the bearing surface of the stairs.

569. Grandstands—Frame within Fire Limits—Grandstands Hereafter Constructed—Fireproof—Frontage—Consents.) (a) Wooden grandstands or tiers of seats commonly known and described as grandstands now constructed or in the process of construction may be erected, repaired or enlarged within the fire limits where no part of any such structure shall be within sixty feet of any other building or structure. All grandstands hereafter erected within the fire limits, except as hereinafter provided, shall be made of fireproof or unprotected steel construction. The enclosing walls, if enclosed, shall be made of fireproof or incombustible materials, but the seats may be made of wood. Grandstands outside the fire limits, or inside the fire limits where the seating capacity does not exceed five thousand persons, may be constructed of wood, but no part of any such structure shall be within less than sixty feet of any other building or structure. The braces, supports and the underside of all seats, including bleacher seats, shall be treated with a fire-retarding solution once a year before opening up the premises containing such stand to the public.

(b) Every person, firm or corporation desiring a permit for the construction of a grandstand, except in connection with such as are now in existence, shall first obtain the consent in writing of the owners of a majority of the frontage on both sides of the street or streets on each side of the block or square in which it is desired to erect such grandstand.

(c) The Commissioner of Buildings shall inspect or cause to be inspected all tiers of seats and grandstands each year before same are opened to the public for the purpose of ascertaining whether they comply with the City ordinances and the rules and regulations of the Department of Buildings. A fee shall be charged for such annual inspection as follows:

Where the seating capacity is 5,000 or less the fee shall be \$10.00.

Where the seating capacity is more than 5,000 the fee shall be \$25.00.

570. Width of Aisles and Exits—Number of Seats Between Aisles and Width and Spacing of Seats.) (a) The width of aisles and exits in all grandstands contemplated in Section 567, hereafter constructed, shall

in no case be less than thirty-six inches, and such width shall be increased toward the exits which serve as regular entrances, such width being computed at the rate of eighteen inches per each one hundred seats, or fractional part thereof, in non-fireproof grandstands, and at the rate of twelve inches for each one hundred seats, or fractional part thereof, in fireproof grandstands.

In every grandstand or stadium hereafter erected of fireproof or of unprotected steel construction, having not less than 40,000 seats, and in which the seats are built without backs, the width of aisles shall in no case be less than 36 inches and such width shall be increased toward the exits and shall be computed, at the wider end, at a rate of not less than 10 inches in width for each 100 seats and for fractional parts of 100 seats a proportionate part of such rate of width shall be added. In such grandstand or stadium the width of stairways and their connecting passageways shall be computed at a rate of not less than 12 inches for each 100 seats and for fractional parts of 100 seats a proportionate part of such rate of width shall be added; provided that where inclined walks having no vertical risers throughout their entire length and having a maximum gradient of 15 feet rise in each 100 feet of horizontal run are used in lieu of stairs, the width of such inclined walks and their connecting passageways shall be computed at a rate of not less than 8 inches for each 100 seats and for fractional parts of 100 seats a proportionate part of such rate of width shall be added. All doorways affording ingress to and egress from such grandstand or stadium to or from the open space, streets or other thoroughfares surrounding such grandstand or stadium shall be computed at a rate of not less than 12 inches in width for each 100 seats and for fractional parts of 100 seats a proportionate part of such rate of width shall be added.

(b) The number of seats between aisles in any row shall not exceed twenty in non-fireproof grandstands, nor thirty in fireproof grandstands. Where seats are built without backs, the rows shall be spaced at least 25 inches from back to back of seat boards, and in computing the seating capacity each 18 inches in length of seat boards shall be counted as one seat.

571. Temporary Seating Structures.) Temporary seating structures for shows and outdoor exhibitions and the observation of holidays and special occasions may be built of combustible material, providing they are built structurally strong enough to support a live load of one hundred pounds per square foot, and comply with the provisions of Class IVb in regard to means of exit, aisles and rows of seats; and provided, further, that a permit be secured from the Commissioner of Buildings, which shall in no case be issued by him until the party desiring to erect said temporary seating structure shall secure the written consent of a majority of the property owners or their duly authorized agents, on both sides of the street on which said temporary seating structure is to be located in the block between the two nearest intersecting streets. Any permit issued for any such temporary seating structure as hereinabove provided for in this section shall not entitle the person so receiving said permit to use said temporary seating structure for more than ten consecutive days from the first day on which it is so used; and any temporary seating structure provided for in this section shall be removed within ten days after the use of the same as provided for in this section, and if not so removed it shall be the duty of the Commissioner of Buildings to order the same to be removed or torn down by the Fire Commissioner at the expense of the owner thereof.

572. Use of Roofs—Requirements.) Whenever the roof of any building is used for any purposes whatever, except as a covering for the building, it shall be considered as a story of the building and subject to such restrictions of use and such requirements of construction as are provided for the building by the ordinances of the City of Chicago.

Amusement Parks.

573. Frontage Consents Required.) It shall hereafter be unlawful for any person, firm or corporation, to build, construct, establish, produce or carry on, any amusement within any ground, garden or enclosure of the kind commonly known and described as amusement parks, wherein shows of different classes are offered or presented by one or more concessionaries, without first securing written frontage consents as required by the ordinances of the City of Chicago. Such frontage consents shall be filed with the Commissioner of Buildings before a permit shall be issued for the construction of any building or structure connected in any way with such amusement or amusement park.

574. Requirements.) (a) Buildings erected after March 13, 1911 within an amusement park, located outside the fire limits, shall comply, except as herein otherwise specified, with the provisions of Class IVb.

(b) Buildings erected after March 13, 1911 within amusement parks located outside of the fire limits and not exceeding one story in height and which do not contain more than one balcony may be built with a self-supporting steel frame designed as required by this chapter. Such structures may be enclosed with metal lath covered with cement plaster, which plaster shall be not less than one and one-third inches thick, or such structures may be enclosed with galvanized iron. The roofs of such structures may be of ordinary construction supported on steel trusses and covered with a gravel or composition roof, approved by the Commissioner of Buildings.

(c) Every moving picture theatre hereafter built within an amusement park shall comply with the provisions of Class IVc.

575. Open Space Between Buildings.) There shall be an open and unobstructed space of not less than four feet between each and every frame building erected after March 13, 1911, in an amusement park, where the buildings do not exceed twenty feet in height, and of not less than six feet where the buildings are over twenty feet and less than thirty feet in height, and of not less than ten feet when the buildings are over thirty feet in height. Where brick or concrete or other fireproof walls of full seven-tenths inches in thickness are used between such buildings and where such buildings are built of slow-burning construction, these spaces shall not be required, but, in such cases, there shall be a space of ten feet in width at intervals of every two hundred feet.

576. Roller Coaster Devices.) No roller coaster, scenic railway, or other riding, sliding, or rolling device, shall be hereafter erected of a greater height from the ground than 55 feet. All such coasters, railways, riding or other devices shall be equipped with safety clutches. The cars, or any receptacles, which persons are permitted to occupy, or in which they are permitted to travel, ascend or descend, shall have hand rails of sufficient number and height to prevent people from being thrown therefrom, and of such character as shall be approved by the Commissioner of Buildings.

577. Roller Coasters—Scenic Railways, Etc.—Permit Fee—Certificate of Test and Safety.) (a) Before any roller coaster, scenic railway, water chute or other mechan-

ical riding, sailing, sliding or swinging device is erected, either in existing or new amusement parks, a detailed plan shall be submitted to the Commissioner of Buildings, for his approval or rejection, and, if approved, a permit shall be procured by the person, firm or corporation desiring to erect such device. The permit fee shall be fifty dollars for each such device. Before such device is opened to the public each season, a certificate of inspection, signed by a competent engineer, approved by the Commissioner of Buildings, must be furnished, certifying to the practicability, strength and safety of such devices, and such device shall be examined by the Commissioner of Buildings or his employees upon completion and also each year before the opening up to the public.

(b) The Commissioner of Buildings shall inspect or cause to be inspected all buildings to be used for purposes of exhibition, amusement or entertainment which are attended by the public that are within or connected with an amusement park, each year before said buildings are open to the public, for the purpose of ascertaining whether they comply with the City ordinances and the rules and regulations of the Department of Buildings. The fee for such annual inspection shall be five dollars for each building so inspected.

(c) The Commissioner of Buildings shall inspect or cause to be inspected all amusement devices, mechanisms and structures other than riding devices and other than buildings within an amusement park, for the purpose of ascertaining whether they comply with the City ordinances and the rules and regulations of the Department of Buildings; and the fee for such annual inspection shall be ten dollars for each device, mechanism and structure so inspected.

(d) The Commissioner of Buildings shall inspect or cause to be inspected all amusement devices operated by animals or by other motor power and all other riding, sliding, sailing, swinging or rolling devices situated on any lot or tract of land outside of the amusement park before said devices are open to the public. Where said devices are taken down, removed and reassembled or re-erected in another location, the Commissioner of Buildings shall inspect or cause said devices to be reinspected after each removal and before said devices are open to the public, for the purpose of ascertaining whether they comply with the City ordinances and the rules and regulations of the Department of Buildings. A fee of five dollars shall be made for every such inspection or re-inspection.

578. Must Comply With All Ordinances.) It shall be unlawful for any person, firm or corporation to construct, alter or operate any amusement park or any building or structure therein unless they comply with the ordinances of the city relative thereto.

578-A. Class IV-e Defined.) In Class IV-e shall be included every building hereafter erected having an arena, amphitheater or enclosed stadium for the purpose of exposition and exhibition where the seating capacity of such building shall exceed 40,000 persons. Where any building for this purpose has a seating capacity of less than 40,000 it shall be built to conform with the provisions of Class IV-b.

Frontage—Seating More Than 40,000.) Every building of Class IV-e containing an arena, amphitheater or enclosed stadium of an aggregate seating capacity of 40,000 or more shall have a frontage upon four open spaces three of which shall be public streets, while the other, if not a street, shall be a public or private alley, of a width of not less than ten feet, each end opening directly on a public street; provided that a fireproof passageway at grade level not less than seven feet in width may be used in place of one such alley, if such passageway connects with a public street at both ends.

Auxiliary Building—Heights and Construction of Communicating Doors.) (a) Every building hereafter erected and connected with or made part of any building used in whole or in part for the purposes of Class IV-e, shall, if sixty or less feet in height, be of fireproof, mill or slowburning construction, except as otherwise provided in this chapter, and, if more than sixty feet in height, of fireproof or incombustible construction, as herein provided.

(b) No existing building, other than of fireproof construction, shall be connected to any building of Class IV-e now existing or hereafter constructed, unless there is, between such building, a fire wall constructed as required by Section 732 of this Chapter and extending from the ground to and through the roof.

(c) In all such cases where both buildings are not of fireproof construction, each opening in the intervening walls shall be equipped with automatic double fire-doors as required by Section 789 of this Chapter.

Existing Building—Used for Class IV-e and for Other Purposes.) Shall comply with Par. 518, Class IV-b, of this Chapter.

Construction. Every building used for the purpose of Class IV-e, hereafter erected, containing a hall or room, arena, amphitheatre or enclosed stadium having an aggregate seating capacity of 40,000 or more shall be built of fire-proof construction, except as hereinafter provided.

The roof may be covered with a non-corrosive sheet steel deck and an insulating material may be used provided the roof is covered with an incombustible roofing material. The soffits of all rooms, tunnels, balconies and galleries and the underside of roof trusses shall be protected with metal lath and plaster. The ceiling may be treated with acoustic materials provided they are fastened to a metal lath and plastered ceiling as above specified. The underside of metal framing for all balconies and galleries shall be protected with a suspended ceiling of metal lath and plaster. The roof trusses shall be fireproofed, however, if the lowest member of the truss is 20'-0" or more above the highest tier of seats then a suspended ceiling of metal lath and plaster will be permitted; provided that building used mainly for exposition and exhibition purposes, and not used for theatrical purposes, and which comply with this ordinance as to stairways, exits and fire escapes, may have their temporary seats, boxes, show cases, platforms, or booths, constructed of combustible material; provided, however, that any draperies, buntings or other decorations shall be treated with a fire retardant solution and shall be treated and installed subject to the approval of the Chief Fire Prevention Engineer.

Buildings in Which Seats Are Not Fixed—Seating Capacity.) Seating capacity shall be estimated as provided in Par. 520, Class IV-b, of this Chapter.

Limitations of Floor Levels—Height Above Sidewalks—Skating Rinks.) Every building used for the purpose of Class IV-e, including a skating or hockey rink, shall be constructed, operated and maintained with its main floor level not more than one foot above the inside sidewalk grade of the street upon which such building containing same fronts.

Allowance for Loads in Construction of Floors.) Shall comply with Par. 522, Class IV-b, of this Chapter.

Stairways—Entrances and Exits, Handrails, Width of.) The width of stairways in building used wholly or in part for the purpose of Class IV-e, shall be 9' for every 100 seats of the aggregate seating capacity of all rooms used for the purpose of Class IV-e in such buildings; but no stairway shall be less than four feet wide in the clear. Every hall or room used for the purpose of Class IV-e, in the building hereafter

erected shall have access to not less than eight stairways.

Balconies and galleries shall have a continuous aisle, corridor or connecting passageway completely surrounding the arena, without obstructions directly connected to stairways and fire escapes. All aisles, corridors or connecting passageways shall be 8' in width for every 100 seats. The width of corridors and connecting passageways shall not be less than 48" and such width shall be increased towards the exits, and shall be computed at the wider ends at a rate of not less than 8' in width for every 100 seats.

Every stairway shall have handrails on each side thereof; stairways which are over seven feet wide shall have double intermediate handrails with end newel posts at least five and a half feet high; no stairway shall ascend a greater level than 13 feet 6 inches without a level landing, which landing shall be not less than four feet wide measured in the direction of the run of the stairs.

Balconies and Galleries—Designation of.) Shall comply with Par. 524, Class IV-b, of this Chapter.

Shall comply with Par. 525, Class IV-b, of this Chapter.

Aisles—Steps in Aisles — Passageways—Cross Aisles Leading to Emergency Exits.)

(a) Aisles in rooms used for the purpose of Class IV-e shall have in the aggregate a width of 8' for each 100 of the seating capacity of such room, and for fractional part of 100 a proportionate part of 8' shall be added; but no aisle shall be less than 2'-6" in width.

(b) Steps shall be permitted in aisles only as extending from bank to bank of seats and whenever the rise from bank to bank of seats is less than five inches the floor of the aisles shall be made on inclined plan, and where steps occur in outside aisles or corridors, they shall not be isolated, but shall be grouped together, and there shall be a light so placed as to illuminate such steps in such outside aisles or corridors.

Corridors, Passageways, Hallways and Doors—Width of.) Shall comply with Par. 527, Class IV-b, of this Chapter.

Seats—Number in Rows.) There shall be not more than thirty seats in any one row between aisles and in a room or rooms used for the purposes of Class IV-e of the seating capacity greater than 40,000 persons, there shall be an aisle on each side of any bank of seats, where there are over fifteen seats in a row. Rows of seats shall not be less than thirty-two inches from back to back and no bank of seats shall have a greater rise than 24"; provided that all banks of seats having a greater rise than 20" shall have a 1½" diameter iron railing at least 2'-6" high, supported by a vertical member at least every 8'-0" thoroughly anchored to the structural members below.

Emergency Exits.) (a) Emergency exits and stairways shall be provided outside of any and all rooms used for the purpose of Class IV-e which have a seating capacity greater than 40,000, and such emergency exits shall have a width equal to one-half of the width of the main exits, and such emergency exits shall lead directly to a public thoroughfare.

(b) Every stairway fire escape emergency exit shall be located and constructed in accordance with the requirements of Sections 881, 882 and 885, but in no case shall any room used for the purpose of Class IV-e located above the third story of any building have less than one stairway escape emergency exit.

Doors to Open Outward.) Shall comply with Par. 530, Class IV-b, of this Chapter.

Capacity—Certification for License.) Shall comply with Par. 537, Class IV-b, of this Chapter.

Lighting Service Requirements.) Shall comply with Par. 542, Class IV-b, of this Chapter.

ARTICLE VIII.

Class V.

579. Class V Defined.) In Class V shall be included every building which is used as a public theater where an admission fee is charged and in which movable scenery is used, and every assembly hall hereafter erected having a seating capacity of over 300 and containing a permanent stage on which scenery and theatrical apparatus are used and regular theatrical vaudeville performances are given, and every theater, assembly hall, building or place with a seating capacity of more than 1,000 persons used for the exhibition of moving pictures; provided, however, that public halls and club halls with a seating capacity of less than six hundred, although occasionally used for theatrical presentation, shall not be considered as public theatres within the meaning of the term as used in this section, notwithstanding the fact that movable scenery is used upon the stages thereof on such occasions, and such public halls and club halls shall not be considered as buildings of Class V as herein defined. Such public halls and club halls shall be included in Class IV as defined in this chapter.

Whenever words are used in the articles of this chapter which relate to the classification of Class V buildings into buildings in existence and buildings hereafter erected, such words (unless expressly shown to be intended otherwise) shall be understood as referring to the date July 18, 1905, at which time the original ordinance making such classification was passed by the city council.

580. Must Comply with General and Special Provisions.) In addition to the provisions of this article every building of Class V shall also comply with the general provisions of this chapter.

581. City Officers Empowered to Enter Buildings.) The Commissioner of Buildings, Commissioner of Health, Fire Commissioner, Chief Fire Prevention Engineer, Commissioner of Gas and Electricity, Superintendent of Police, or any of them, and their respective assistants, shall have the right to enter any building used wholly or in part for the purposes of Class V, and any and all parts thereof, at any reasonable time and at any time when occupied by the public, in order to examine such buildings, to judge of the condition of the same and to discharge their respective duties, and it shall be unlawful for any person to interfere with them, or any of them, in the performance of their duties.

582. City Officers Empowered to Close.) The Commissioner of Buildings, Commissioner of Health, Fire Commissioner, Chief Fire Prevention Engineer, Commissioner of Gas and Electricity, Superintendent of Police, or any one of them, shall have the power, and it shall be their joint and several duty, to order any building used wholly or in part for the purposes of Class V, closed, where it is discovered that there is any violation of any of the provisions of the chapter, and keep same closed until such provisions are complied with.

583. License—Mayor Shall Revoke.) Upon a report to the Mayor by the Commissioner of Buildings, Commissioner of Health, Fire Commissioner, Chief Fire Prevention Engineer, Commissioner of Gas and Electricity, or the Superintendent of Police that any requirement of this chapter or that any order given by them or any of them in regard thereto has been violated, or not complied with, the Mayor shall revoke the license of any such theatre or place of amusement so reported and cause the same to be closed.

Buildings of Class V Now in Existence.

584. Buildings of Class V Now in Existence.) The following provisions shall apply

to Class V buildings in existence at the time of the passage of this ordinance:

585. Walls—Outside—Must Comply with Requirements of Section 732.) The outside walls of all such buildings in existence at the time of the passage of this ordinance, the roofs or ceilings of which are carried on trusses or girders of a span of fifty feet or more shall comply with the requirements of Section 732.

586. Columns in Walls—Alterations.) If iron or steel columns are introduced in the walls referred to in Section 585 the brick work around the same shall be bonded into that of the connecting walls, and each of such columns shall be fireproofed as provided in Sections 833 and 839 of this chapter. All alterations in such existing buildings, to make them comply with the requirements of this chapter may be executed with the same kind of materials as those originally used in the construction of such buildings; provided, that after the said building is brought into compliance with the provisions of this chapter, then all subsequent alterations, enlargements, repairs, replaced or strengthened structural parts damaged by fire, wear and tear, or otherwise, shall be made of fireproof construction or iron or steel construction covered with fireproof materials, as provided by this chapter.

587. Other Classes Built in Conjunction with Class V—Doors for Openings Between Connecting Buildings.) In all cases where existing buildings used wholly or in part for the purposes of Class V are built in conjunction with or as part of buildings devoted to the uses of other classes and where such buildings of the other classes, as specified in this ordinance, are not built entirely of fireproof construction, double iron doors shall be placed at each connecting opening between such buildings of Class V and the building connected therewith.

588. Floor Levels—Limitations of.) (a) Any audience room used for the purposes of Class V now in existence containing in the aggregate not more than five hundred seats, if in a fireproof building, may be maintained in any story thereof, but in such case there shall be at least two stairways to the ground, from the floor or floors on which each such room is located, each of which stairways shall be not less than four feet in width in the clear.

(b) In existing buildings of fireproof construction, having an audience room with a seating capacity of more than five hundred and less than fifteen hundred, the lowest bank of seats of the main floor thereof shall be not more than twelve feet above the street level, and every such building shall in all other respects conform to the requirements of this ordinance. The main floor of any existing theatre of any kind of construction shall not be raised above its present elevation.

589. Loads—Allowance for Live Loads in Construction of Floors of Class V.) For all buildings of Class V all floors shall be designed and constructed in such manner as to be capable of supporting in all their parts, in addition to the weight of floor construction, partitions and permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floors.

590. Stairways—Handrails—Entrances and Exits.) (a) Stairways, affording egress from any room or rooms used for the purposes of Class V shall be equivalent in width to twenty inches for every one hundred of seating capacity of such room, and for fractional parts of one hundred a proportionate part of twenty inches shall be added, but no such stairway shall be less than four

feet wide in the clear, except as hereinafter provided in this section.

(b) All such stairways shall have hand railings on each side thereof and shall not ascend to a greater height than thirteen feet six inches without a level landing, and the length and width of such landing shall not be less than the width of the stairs. No run of stairs shall consist of less than six risers between platforms, and risers shall not be placed on return platforms. Stairways which are over 7 feet wide shall have double intermediate handrails with end newel posts at least 5½ feet high.

(c) Steps shall not have a greater rise than 8 inches, treads shall not be narrower than 10 inches, and winders shall not be used on any staircase, except where circular staircases are expressly permitted.

(d) In existing theatres every balcony and gallery shall have separate and distinct entrance stairways from the sidewalk level, except that in cases where the vestibule or entrance to any such theatre is not more than fifteen inches, or two steps, above the sidewalk level and such steps are at or near the building line, the stairways to such balcony and gallery may ascend from the floor of such vestibule or entrance, but if the run of the stairs at the bottom is not toward the street, there shall be a hand rail or rails, three feet above the floor constructed from the foot of such stairways for a distance of not less than five feet leading toward the street. All doors intervening between such stairways and the street shall, during each and every performance, be kept unfastened.

(e) There shall be an iron stairway or stairways from the stage to the fly galleries and gridiron, continuing to the roof of the building or to some fireproof passageway or exit. Such stairways may be circular. Such circular stairways, however, shall not be used for access to the dressing rooms.

(f) Every stairway leading to a box or boxes shall be independent of all other stairs or seats; and such stairway shall not be less than two feet eight inches wide in the clear, when such box or boxes seat not to exceed thirty people, and an additional width of one inch shall be added to such stairway for each additional five persons for whom seating capacity is provided.

(g) Every stairway on the stage side of the proscenium wall shall be not less than two feet six inches wide.

(h) Instead of increasing the width required for entrances, aisles, exits and stairways to that required by this chapter, the owner, lessee or manager of any such theatre shall have the privilege of reducing the number of permanent seats therein until the same ratio between such width and number of seats as hereinbefore provided for shall be established, and if such privilege be taken advantage of, it shall be the duty of the Commissioner of Buildings to make inspection and certify that such ratio actually exists before a license for the operation of any such theatre shall be issued.

591. Floors and Exits.) Floors at all exits shall be level and flush with adjacent inside floors and shall extend for an unbroken width of not less than four feet in front of each exit, and shall be two feet wider than such exit.

592. Seats in Rows Between Aisles.)

(a) Not more than ten seats in any row shall be permitted between aisles in any gallery. On the main floor and balcony not more than eleven seats shall be permitted between aisles; except in rows of seats which are within twenty feet from the exits, in which case thirteen seats shall be permitted between aisles.

(b) Seats shall be not less than twenty inches in width measured at the top of the

seat backs. Rows of seats shall be not less than two feet eight inches from back to back.

No bank of seats shall be of greater rise than twenty-two inches.

(c) All groups of seats shall be so arranged that there shall be an aisle at each side of each group, except that groups of five seats or less may abut upon a tunnel at one side and an aisle at the other. And except that a bank of seats abutting boxes or walls on main floor, balcony, and gallery, of not over five seats in a row, shall be required to abut upon one aisle only.

(d) The number of banks of seats on the main floor shall not exceed fifteen unless an intervening or cross aisle is provided between each fifteen banks of seats or unless a direct exit is provided for each aisle.

(e) The number of banks of seats in the balcony shall not exceed nine unless an intervening or cross aisle is provided between each nine banks of seats or unless a direct exit be provided for each aisle.

593. Limits of Vertical Rise and Requirement for Tunnels in Cross Aisles—Openings in Foyer Wall.) (a) There shall be no more than twelve feet rise measured vertically in any aisles in any floor or in any balcony or in any gallery without a direct exit by tunnel or otherwise to a corridor with free opening on to the gallery stairs or other direct discharge to the street, or at such elevation of twelve feet an intervening or cross aisle leading directly to an exit. No tunnel shall be less than three feet wide in the clear.

(b) There shall be no openings in the foyer wall between the foyer and theatre proper other than the exit openings.

594. Main Floor—Balcony and Gallery—Designation of.) (a) The lower floor of all theatres shall be designated the "Main Floor."

(b) Where there are balconies or galleries, the first balcony or gallery shall be designated the "Balcony," and the second and third balcony or gallery shall be designated, respectively, "Gallery" and "Second Gallery."

595. Aisles—Width of—Shall Lead Direct to Exit—Steps in Aisles.) (a) The minimum width of aisles with diverging sides in any room used for the purposes of Class V shall be two feet eight inches at the end near the stage and not less than three feet at the other end.

(b) The minimum width of aisles with parallel sides shall be three feet.

(c) Every aisle shall lead as nearly as possible directly to an exit, but in no case shall the center line of such exit be more than three feet from the center line of any such aisle leading thereto.

(d) Steps shall not be permitted in aisles except as extending from bank to bank of seats, and no riser shall be greater than 8 inches, and no tread shall be less than 10 inches, and whenever the rise from bank to bank of seats is less than five inches, the floor of the aisles shall be made as an inclined plane, and where steps are placed in outside aisles or corridors they shall not be isolated, but shall be grouped together and a light shall be maintained so that every place where there are steps in inclosing aisles or corridors shall be clearly lighted.

596. Corridors, Passageways, Hallways and Doors—Width of.) (a) The width of corridors, passageways, hallways and doors shall be computed in the same manner as that hereinbefore provided for stairways, excepting, however, that no corridor shall be anywhere less than four feet in width, and no door less than three feet wide, except as otherwise herein provided.

(b) All corridors, passageways, hallways and stairways leading from any balcony or gallery to any toilet room, retiring room, smoking room, check room or private office, shall lead directly to an outer exit of the building. Such corridors, passageways, hallways and stairways shall be at least three feet in width in every part, and shall be unobstructed in every part except by doors, not less than three feet in width in the clear, which shall swing outward and which shall not have locks or catches of any kind whatever.

597. **Doors—Entrance.)** (a) The width of entrance doors to every theatre shall be computed on the basis of twenty inches in the clear to each one hundred permanent seats in the audience room and in addition thereto a proportionate part of twenty inches for the fractional part of one hundred seats shall be added.

(b) No mirror or architectural feature shall be so arranged as to give the appearance of a doorway, window, exit, hallway or corridor where none exists.

598. **Dressing Room Partitions.)** Partitions forming dressing rooms, except where already built, shall be constructed of incombustible material, and such dressing rooms shall be properly ventilated as in the judgment of the Commissioner of Health may be required.

599. **Emergency Exits—Width—Emergency Stairs—Width—Emergency Exits Inside Walls of Buildings—Fire Escapes, Construction—Fire Escapes Leading to Street or Alley—Doors Open Outward.)**

(a) Emergency exits and stairways shall be provided separately for each floor, balcony and gallery and shall be of the same aggregate width as that provided for the main exits, and shall not be less than three feet in width. Such emergency stairways shall be made of iron, steel, or other incombustible materials. Such emergency exits shall be kept free of obstructions of every kind, including snow and ice.

(b) Such emergency exits and stairways may be built inside the walls of the building, provided they are enclosed by a fireproof partition not less than four inches thick separating the exits and stairways from the audience room or auditorium.

(c) If said emergency exits lead outside the building, the opening leading thereto shall have metal doors with wired glass panels. The doors shall open outward, and shall be hung from the inside corner of the jambs, and so constructed as not to project, when opened, beyond the outside face of the wall. Outside shutters will not be permitted, except when they open automatically from the interior, without resistance, and when used or open will automatically fasten, securely, flat against the wall,

so as not to obstruct the passage on the outside; all such automatic devices or attachments to said doors or shutters shall be subject to the approval of the Commissioner of Buildings and the Chief Fire Prevention Engineer.

(d) Whenever any such emergency stairway passes over an exit door, window or other opening, such stairway shall be completely inclosed for a space of five feet greater in width than such opening, by iron, steel or other incombustible material.

(e) All such emergency exits and stairways shall land at the ground level in a public thoroughfare or in some space that connects directly with a street or alley, and direct and immediate exit to such public thoroughfare shall not be obstructed by any doors, gates, bars or obstruction of any character.

(f) Every court in which there is an emergency stairway shall have direct and unobstructed access along the surface of the ground to a street, alley or yard opening into an alley, or street, without entering into or passing through or over any building unless by a fireproof passage at least four feet wide and seven feet high on the court or ground level.

(g) All doors in openings from any and all exits and stairways shall be so constructed that when opened they shall not obstruct any portion of any other doorway, opening or passageway.

(h) All doors affording ingress to or egress from any theatre shall open outward and such doors shall be so constructed and maintained as to require no special knowledge or effort to open them from the interior.

600. **Proscenium Wall—Curtain—Requirements for Other Openings in Proscenium Wall.)** (a) There shall be in every theatre a solid brick wall of the same construction and thickness as is required in outside walls between the auditorium and the stage. The main proscenium opening shall have a substantial steel curtain vertically operated and fireproofed on the stage side, which shall be raised and lowered by mechanical power and shall be in constant use as the regular curtain and act drop.

(b) No combustible material other than painted decorations shall be applied to the audience side of such curtains.

(c) Plans for such curtains shall be approved by the Commissioner of Buildings and a permit obtained previous to its erection. The Commissioner of Buildings shall inspect such curtain semi-annually, for which inspection a fee of five dollars shall be charged.

(d) All other openings in such proscenium wall shall have iron doors, frames and thresholds.

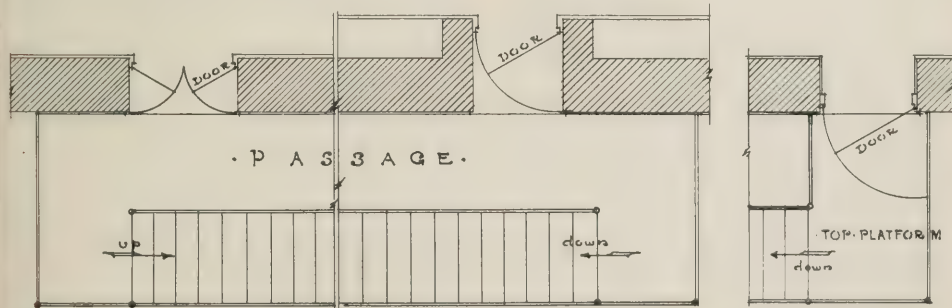


Fig. 3.
EMERGENCY EXITS.
Section 599.

Suggestion how to swing doors, so as not to obstruct passageway.

601. Stage—Construction of—Framing for Scenery.) The framing for the floor of every stage shall be of iron, steel, or reinforced concrete. The stage floor may be of wood not less than one and three-quarters inches thick, provided the underside of stage floor shall be saturated with a fireproof solution satisfactory to the Chief Fire Prevention Engineer. The entire floor construction and the floor of fly galleries, rigging lofts and paint gallery, all railings and supports and stanchions thereon, and all sheaves, pulleys and cables and their supports, shall be of iron, steel or reinforced concrete. All framing for scenery and all stage paraphernalia shall be saturated with a fireproof solution the same as prescribed for stage flooring.

602. Vestibule for Stage Doors.) All doorways and openings in the rear or sides of the stage shall be vestibuled or arranged in a manner satisfactory to the Commissioner of Buildings so as to protect the curtain, scenery and auditorium against draughts of air.

603. Vents—Flue Pipes, Size of—Dampers—Switches for Dampers.) (a) One or more vents, or flue pipes, of metal construction or other incombustible material, suitable for carrying away smoke, approved by the Commissioner of Buildings, and extending not less than fifteen feet above the highest point of the roof and equivalent in area to one-twentieth of the area of the stage, shall be built over the stage.

(b) In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls and shall be continued and run up on the exterior of the building to a point five feet above the highest point of such additional stories.

(c) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a fused cord and by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches or either of them fail to operate. Such stations shall be located in such places on the stage as may be determined by the Chief Fire Prevention Engineer, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

604. Automatic Sprinklers.) (a) A system of automatic sprinklers subject to the approval of the Chief Fire Prevention Engineer, shall be provided and installed in every theatre.

(b) Where water for such system of automatic sprinklers is supplied from a tank, the supports and installation of such tank or tanks shall be subject to the approval of the Commissioner of Buildings.

605. Lighting Requirements—Buildings Class V Now in Existence.) Lighting of every building of Class V, whether now in existence or hereafter erected, shall comply with the requirements for buildings of Class V hereafter erected.

606. Capacity—Certificate for License.) The Commissioner of Buildings shall determine the number of persons which every room used for the purpose of Class V may accommodate according to the provisions of this chapter and shall certify the same to the City Clerk. No more than the number so certified shall be allowed in such room at any one time.

607. Theatres in Frame Buildings Prohibited.) No frame building, or part thereof,

within the city, shall be used as a moving picture, vaudeville or other theatre; provided, that nothing herein contained shall be held to apply to any frame building existing at the time of the passage of this ordinance and in which a moving picture, vaudeville or other theatre is being maintained at the time of the passage of this ordinance, where all the scenery, if any, used in connection with such moving picture, vaudeville or other theatre, is constructed of either sheet-metal or asbestos, and where the amount of exit space for such theatre is at least fifty (50) inches for each one hundred (100) seats therein contained, and where there is no living apartment of any kind used, maintained or occupied as such in any part of said building.

BUILDINGS OF CLASS V HEREAFTER ERECTED.

608. Buildings of Class V Hereafter Erected.) The following provisions shall apply to buildings of class V hereafter erected and used wholly or in part for such purposes:

609. Construction—Walls—Outside Walls—Structures.) All buildings of Class V hereafter erected shall be built of fireproof construction.

610. Frontage—Open Spaces—Fireproof Passageways.) (a) All buildings hereafter erected used wholly or in part for the purposes of Class V shall be located so that they adjoin at least two public thoroughfares, one of which shall be a public street and the other may be a public alley not less than ten (10) feet in width.

(b) The audience room of every such building used for the purposes of Class V shall have either a public thoroughfare or an open space not less than ten feet wide extending from the lowest first floor level to the sky, on each of the two sides other than the proscenium and the foyer. Exit doors shall open onto such public thoroughfare or the bottom of such open space from the respective sides of the stage and of the main floor of the audience room, and onto balconies or platforms built in such public thoroughfare or open space at both the highest and the lowest floor levels of each and every balcony and gallery and the doors opening into such public thoroughfare or open space from any balcony or gallery or from the main floor shall comply with all the requirements prescribed in Section 618 of this chapter.

Provided, however, where such building has a seating capacity of not to exceed 1,000 persons, and in which the seats for the entire audience are located upon the main floor, and where no part of the main floor is higher than four (4) feet above the inside sidewalk grade of the street opposite the main entrance to such building, and where every part of every building connecting thereto or built in conjunction therewith is of fireproof construction the provisions for open spaces alongside audience room as contained in Section 544 applicable to buildings of Class IVc where the entire audience is seated on the ground level shall govern with respect to open spaces, and the provisions of Section 545 shall govern with respect to main floor aisles and direct exits from same.

Provided further that two theatres are erected simultaneously in the same building or in adjoining buildings under the same ownership, and where the aggregate seating capacity of both theater audience rooms taken together does not exceed a total of 2,500 persons, and where said building or adjoining buildings have a frontage upon three public thoroughfares, the said audience rooms may have in common an open space not less than ten feet in width in every part thereof from the line of the proscenium wall along and directly adjacent to each audience

room to the public street upon which such building or buildings face. Such open space shall be clear and unobstructed from the bottom thereof to the sky, and may be considered the equivalent of an open space for each audience room as required by this section.

(c) All such balconies or platforms as are required by this section shall be connected with stairway fire escapes leading to the street level or to the bottom of such open space and in the latter case they shall have their bottom run toward the public thoroughfare and such balconies or platforms and such fire escapes shall comply with all the requirements prescribed in Sections 881, 882 and 885 of this chapter. Every such open space, if it does not open into a public thoroughfare shall communicate with the public thoroughfare at the front side of the theatre by a fireproof passageway leading from the bottom level of such open space to the sidewalk level. Where there is a public thoroughfare behind the stage every such open space shall also communicate with such public thoroughfare by a fireproof passageway leading from the bottom level of such open space to the level of the public thoroughfare behind the stage, and passing under the stage.

(d) The walls of a fireproof passageway shall not be less than four inches thick, and each and every part of such passageway, including each and all of its supports, shall be built of fireproof construction as required in the general provisions of this chapter relating thereto.

(e) Radiators for warming passageways shall be in recesses sufficient in depth to prevent them from obstructing the passageway.

(f) There shall be no steps or risers in fireproof passageways, but where necessary, inclined floors of the full width of the fireproof passageway may be built; the incline of the floor shall not exceed two and one-half inches in height per foot measured horizontally, and no such incline shall be less than ten feet in length. No fireproof passageway shall be less than ten feet wide and eight feet high in any part thereof except at doors, and these door openings shall be not less than eight feet wide and seven feet high.

(g) If the principal entrance corridor of a theatre is at one side and approximately at right angles to the central axis of the audience room, then the center line extended of such principal entrance shall intersect the center axis of the stage and the audience room between the back of the seat most remote from the stage, on said center axis of the stage and the audience room and at a point midway between such seat and the wall opposite the proscenium wall.

611. Buildings of Other Classes Built in Conjunction with Class V.) If buildings used wholly or in part for purposes of Class V, are built in conjunction with or as part of buildings devoted to the uses of other classes, then such buildings of other classes shall be built of fireproof construction.

612. Floor Levels—Live Loads.) (a) The floor level of the highest bank of seats on the main floor shall not be more than three feet above the sidewalk level and the floor level of the lowest bank of seats on said floor shall not be more than eight feet below the sidewalk level.

(b) All floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, permanent fixtures and mechanisms that may set upon the same, a live load of one hundred pounds for every square foot of surface in such floors.

613. Stairways—Handrails—Entrances and Exits.) (a) Stairways affording ingress to or egress from any room used for the purposes of Class V shall be in width equivalent to twenty inches for each one hundred of seating capacity of such room, and for fractional parts of one hundred a proportionate part of twenty inches of width shall be added, but in no event shall any such stairways be less than four feet in the clear, except as hereinafter provided.

(b) All such stairways shall have hand rails on each side thereof, and shall not ascend to a greater height than thirteen feet six inches without a level landing, and the length and width of such landing shall be not less than the width of the stairs; no run of stairs shall consist of less than six risers between platforms, and risers shall not be placed on return platforms. Stairways which are over seven feet wide shall have double intermediate hand rails with end newel posts at least five and one-half feet high.

(c) Steps shall not have a greater rise than eight inches, treads shall not be narrower than eleven inches, and winders shall not be used on any staircase.

(d) Every balcony and gallery shall have one or more separate and distinct exits and stairways to the sidewalk level. All gallery stairways shall lead to the top gallery and there shall be doors in same at each floor for exit purposes only. The bottom run of the stairs shall be directly toward the street. Such stairs may ascend from the vestibule or entrance inside of the buildings, but the bottom riser of such stairs shall be not more than sixty-five feet from the building line. All doors between such stairs and the street shall be kept unlocked and unfastened during each and every performance and until the audience has left the building.

(e) There shall be an iron stairway or stairways from the stage to the fly gallery and gridiron, continuing to the roof of the building or to some fireproof passageway or exit. Such stairway may be circular. Such circular stairways, however, shall not be used for access to the dressing rooms.

(f) Stairs leading to a box or boxes seating not to exceed thirty people in the aggregate shall be independent of all other stairs and seats, and not less than two feet eight inches wide in the clear. For each additional twenty-five persons for whom seating capacity is provided, or major portion thereof, in such box or boxes there shall be an additional five inches in width of such stairway.

(g) All stairways on the stage side of the proscenium wall shall be not less than two feet six inches wide.

614. Floors at Exits—Seating.) (a) Floors at all exits shall be level and flush with adjacent inside floors and shall extend for an unbroken width of not less than four feet in front of each exit, and shall be two feet wider than such exit.

(b) There shall not be more than ten seats in any one row between aisles.

(c) Seats shall be not less than twenty inches in width, measured at the top of the seat backs.

(d) Rows of seats shall not be less than two feet ten inches from back to back.

(e) No bank of seats shall have a greater rise than twenty inches. A bank of seats abutting boxes or wall on main floor, balcony or gallery of not over five seats in a row, shall be required to abut upon one aisle only.

(f) Seats in loges and boxes shall be limited in the ratio of one seat for every six hundred and eighty square inches of floor area in such loge or box.

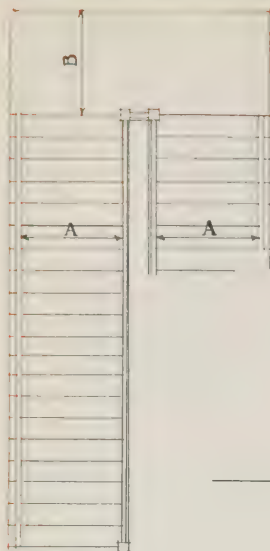


Fig. 4.

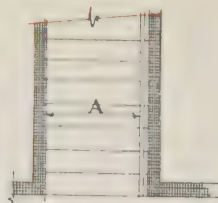


Fig. 5.

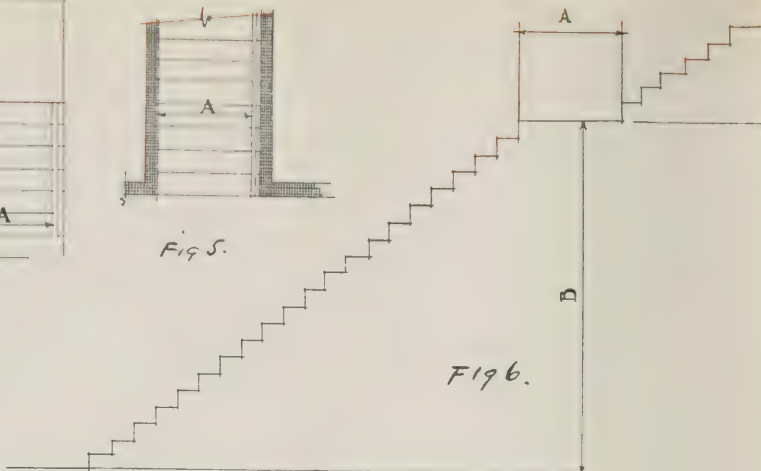


Fig. 6.

STAIRWAYS.

Sections 551, 650, 664, 667, 701, 878, 880 and others.

Fig. 4 (A) Shows measurement of stairways where hand rails are required on each side.

(B) Shows measurement of landing.

Fig. 5. Measurement of stairway where hand rail is required on one side only.

Fig. 6 (A) Landing.

(B) Stairways shall not ascend to an unlimited height (B) without a landing (A), and (A) shall not be less in width and length than (A) Fig. 4 measurement of stairs.

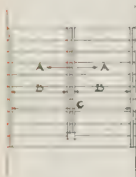


Fig. 7.



Fig. 8.

Fig. 7. Over 7' 0" (for exceptions see ordinance) wide stairways (C) shall have double intermediate hand rails. In plan (Fig. Sec. AA).

(B) Measurement of stairs where double intermediate hand rails occur.

(C) Measurement of stairs where double intermediate hand rails do not occur, as in general case, Fig. 4 (A).

Fig. 8. Newel post 5½' 0" high (A) required for stairs as referred to in Fig. 8.

EXPLANATORY SUGGESTION FOR DOUBLE STAIRCASE HAND RAIL SECTION A-A ON PLAN

(g) All groups of seats shall be so arranged that there shall be an aisle at each side of each group, provided groups of five seats or less may abut upon a tunnel at one side and an aisle on the other side.

(h) The number of banks of seats on the main floor shall not exceed fifteen, unless an intervening or cross aisle is provided between each fifteen banks of seats or a direct exit is provided for each aisle. The number of banks of seats in the "balcony" and "galleries" shall not exceed nine, unless an intervening or cross aisle is provided between each nine banks of seats or a direct exit is provided for each aisle.

615. **Limit of Rise in Floor — Opening in Foyer Wall.** (a) There shall be no more than eleven feet rise, measured vertically, in any main floor or in any gallery or in any balcony without a direct exit by tunnel or otherwise, to a corridor with free opening onto the gallery stairs or other direct discharge to the street or at any such elevation of eleven feet an intervening

or cross aisle leading directly to an exit. No tunnel shall be less than four feet wide in the clear.

(b) There shall be no openings in the foyer wall between the foyer and theatre proper other than the exit openings.

616. **Main Floor—Balcony and Gallery—Designation of.** (a) The lower floor of every theatre shall be designated the "Main Floor."

(b) Where there are balconies or galleries, the first balcony or gallery shall be designated the "Balcony" and the second and third balcony or gallery shall be designated, respectively, "Gallery" and "Second Gallery."

617. **Width of Aisles—Exit from Aisles—Steps in Aisles.** (a) The minimum width of aisles with divergent sides in any room used for the purpose of Class V shall be two feet eight inches at the end nearest the stage and not less than three feet at the other end. The minimum width of aisles with parallel sides shall be three feet.

(b) Every aisle shall lead directly to an exit. An exit located at the end of any aisle and at right angles thereto shall be considered a direct exit.

(c) Steps shall not be permitted in aisles except as extending from bank to bank of seats, and no riser shall be more than eight inches in height, and no tread shall be less than ten inches in width, and wherever the rise from bank to bank of seats is less than five inches, the floor of the aisle shall be made as an inclined plane, and where steps are placed in outside aisles or corridors they shall not be isolated but shall be grouped together, and a light shall be installed so that every place where there are steps in such aisles or corridors shall be clearly lighted.

618. **Corridors — Passageways — Hallways and Doors—Width of—Leading from Toilet Rooms and Cloak Rooms to Outer Exits of the Building—Width of Entrance Doors.** (a) The width of corridors, passageways,

hallways and doors shall be computed in the same manner as that hereinbefore provided for stairways, provided, however, that no corridor shall be less than five feet in width and no doorway less than three feet wide, except as otherwise herein provided.

(b) Every toilet room, retiring room, smoking room, cloak room, check room or private office which is accessible from any corridor, passageway, hallway or stairway leading from any floor, balcony or gallery shall, in addition to the entrance thereto, have an exit arranged in such manner as to permit of direct passage through such room or office, without returning, to an outer exit of the building. Corridors, passageways, hallways and stairways shall be at least four feet in width in every part between such balcony or gallery and such outer exit, and shall be unobstructed in every part, except by doors not less than three feet in width in the clear, which shall swing outward and which shall not be provided with locks or catches of any kind whatever.

(c) The width of entrance doors to every theatre shall be computed on the basis of twenty inches in the clear to each 100 permanent seats in the audience room, and in addition thereto a proportionate part of twenty inches for the fraction part of 100 seats remaining shall be added.

619. Emergency Exits and Stairs—Width of—Emergency Stairs—Construction of, Requirements—Shall Not be Obstructed—Emergency Exits Inside Walls of Buildings—Doors to Open Outward. (a) Emergency exits and stairways shall be provided separately for each floor, balcony or gallery and shall be of the same aggregate width as that provided for the main exits, and shall be not less than three feet in width. Such emergency stairway shall be made of iron, steel or other incombustible material.

(b) Such emergency exits and stairways may be built inside the walls of the building, provided they are enclosed by a fire-proof partition not less than four inches thick, separating the exits and stairways from the audience room or auditorium.

(c) If such emergency exits lead outside the building, the openings leading thereto shall have metal doors with wired glass panels. The doors shall open outward, and shall be hung from the inside corner of the jambs, and so constructed as not to project, when opened, beyond the outside face of the wall, and outer shutters shall not be permitted.

(d) Whenever such emergency stairway passes above an exit door, window or other opening, such stairway shall be completely enclosed by iron, steel or other incombustible material for a space of five feet greater in width than such opening, and such openings below such emergency stairway shall be equipped with approved metal frames and doors or metal sash and wired glass.

(e) All such emergency exits and stairways shall land at the ground level in a public thoroughfare or in some space that connects directly with a street or alley, and direct and immediate exit to such public thoroughfare shall not be obstructed by any door, gate, bars or obstructions of any character.

(f) Every court in which there is an emergency stairway shall have direct and unobstructed access along the surface of the ground to a street, alley or yard opening into an alley or street, without entering into or passing through or over any buildings unless by a four-foot wide fire-proof passage on the court or ground level.

(g) All doors in openings from emergency exits and stairways shall be so constructed that when opened they will not obstruct any portion of any other doorway, opening or passageway.

(h) All doors affording ingress to or egress from any theatre shall open outward.

620. Proscenium Wall Curtain and Requirements — Permit for and Inspection of Curtain. (a) There shall be a solid masonry wall of the same construction and thickness as is required in the outside walls of the building in which such theatre is located between the auditorium and the stage.

(b) The main proscenium opening shall have a vertically operated steel curtain which shall, when it is lowered, completely close such proscenium opening. The curtain shall be raised and lowered by hydraulic power, and shall be in constant use as the regular curtain and act drop.

(c) The lowering of the curtain shall be controlled from not less than two points in the building, one of which shall be from the stage level and the other shall be designated by the Commissioner of Buildings.

(d) The curtain shall have a steel covering on the outer or auditorium side. The stage side covering shall be of a non-heat-conducting substance of such a thickness and such material as shall stand a test of two thousand degrees Fahrenheit on the stage side for fifteen minutes without heating the opposite side to a higher temperature than three hundred and fifty degrees Fahrenheit.

(e) All metal work with the exception of the frame shall be covered with such non-heat-conducting substances on the stage side.

(f) The curtain shall operate vertically in steel guides of such a cross section that the edges shall engage and secure the edges of the curtain and prevent the curtain from leaving the guiding channel or channels if the curtain should tend to buckle or bag either inward or outward. No metal in the guide channel or in the engaging edge of the curtain shall be less than three-eighths of an inch thick. The joints of the curtain with the proscenium wall, with the stage floor and with the head of the opening shall be made gas tight as nearly as practicable.

(g) The calculations for the strength of the curtain, the curtain guides and the guide anchors, and the workmanship, shall be according to the best modern engineering practice. The stresses in the material and in the various sections of steel shall be within the safe limits of stress described in this ordinance.

(h) No part of a curtain or of the curtain guides shall be supported by or fastened by any combustible material.

(i) The supports of the curtain and the curtain guides and edges and the curtain shall be of sufficient strength to safely resist either inward or outward a pressure of five pounds for each and every square foot of the curtain.

(j) No combustible material other than painted decorations shall be applied to the audience side of any such curtain.

(k) Plans for every such curtain shall be approved by the Commissioner of Buildings and a permit obtained therefor previous to its erection. The Commissioner of Buildings shall inspect such curtain semi-annually, and for each such inspection a fee of five dollars shall be charged.

(l) Every other opening in such proscenium wall shall have self-closing regulation standard iron fire doors and iron frames and thresholds; such doors and frames shall be built in such a manner as to resist warping.

(m) Buildings for the exhibition of moving pictures and with a seating capacity of more than 1,000, where such buildings contain a stage of any area or a platform that exceeds 312 square feet in area, shall be constructed so as to comply in every respect with the requirements for buildings of Class V hereafter erected.

Where a stage is not desired and such buildings are equipped with a platform not exceeding 312 square feet in area, the proscenium wall and the several ordinance requirements for stages upon which scenery is used may be omitted and no scenery, curtains, drapes, properties or effects of any description whatsoever can be used on, above or about such platform. The said platform shall be built of fireproof construction and shall have three sides open. The front edge of the platform shall not at any point extend into the auditorium more than nine feet measured from the inside face of the rear wall of the building. The rear of the platform shall abut the rear wall of the building. Immediately forward of the rear wall of the building an auxiliary wall of fireproof construction may be built extending from floor to ceiling to form a recess for the rear four feet of the platform depth. The auditorium face of this wall at its junction with the side edge of the platform shall not be distant more than four feet from the inside face of the rear wall of the building. The said wall may extend perpendicular to the longitudinal axis of the platform and auditorium, or may curve inward toward the auditorium at a radius in length equal to the width of the auditorium, the curve to be described from a center point on the longitudinal axis of the auditorium, the sides and top of the recess to be returned flush with the edge of the auxiliary wall to the rear wall and no openings to penetrate the recess except doorway opening at either side to afford access to platform from a stairway. Not more than two stairways may ascend from the auditorium floor to platform and the total width of stairways shall not exceed eight feet. The floor for 10 feet in every direction about the platform shall be constructed at the same general plane or elevation as the floor on which the first row of seats are placed. Side boxes or organ lofts may be constructed extending to the rear wall of the building but shall in no case come within 10 feet of edge of platform. The ceiling of the auditorium shall extend over the platform to the back wall of building and no drop beams or other construction shall extend below the ceiling level within 10 feet of the vertical projection of the platform. The screen for the display of pictures shall be attached to the rear wall of the building and not to exceed six inches away from same. The moving picture screen drape shall be installed and maintained subject to the approval of the Chief Fire Prevention Engineer. No scaffolding, paint bridge, grill work, gridiron, rigging loft or any device or mechanism, stationary or portable, for the handling, maintaining, storing or exhibiting of any scenery, drops, curtains, wings, effects or properties shall be installed used, maintained or stored above, on or about said platform.

621. Stage—Construction of—Framing for Scenery.) The framing for the floor of every stage shall be of iron, steel or reinforced concrete. The stage floor may be of wood not less than two and three-quarters inches thick, provided the underside of stage floor shall be saturated with a fireproof solution satisfactory to the Chief of Fire Prevention and Public Safety. The entire floor construction and the floor of fly galleries, rigging lofts and paint gallery, all railings and supports and stanchions thereon, and all sheaves, pulleys and permanent cables and their supports shall be of iron, steel or reinforced concrete. All framing for scenery and all stage paraphernalia shall be saturated with a fireproof solution the same as prescribed for stage flooring.

622. Vestibules for Stage Doors.) All doorways and openings in the rear or sides of the stage shall be vestibuled or arranged in a manner satisfactory to the Commissioner of Buildings, so as to protect the

curtain, scenery and auditorium against draughts of air.

623. Structures Over Ceiling—Construction.) If any structure is built over the ceiling or roof of any theater, the different members of the girders or trusses supporting same shall be fireproofed in the manner prescribed for columns of fireproof buildings as specified in the General Provisions of this chapter.

624. Vents—Size of—Flue Pipes—Dampers—Switches for Dampers.) (a) One or more vents or flue pipes of metal construction, or other incombustible material, suitable for carrying away smoke, and approved by the Commissioner of Buildings, and extending not less than fifteen feet above the highest point of the roof, and equivalent in area to one-twentieth of the area of the stage, shall be built over the stage.

(b) In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls and shall be continued and run up on the exterior of the building to a point five feet above the highest point of such additional story.

(c) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a small tarred hempen cord and also by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches or either of them, fail to operate. Such stations shall be located in such places on the stage as may be determined by the Fire Commissioner, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

(d) All fuse boxes shall be surrounded by two thicknesses of fireproof materials, with an air space between, and no fuses shall be exposed to the air between the switchboards.

625. Standpipes—Automatic Sprinklers—Tanks for Water.) (a) A system of standpipes and of automatic sprinklers subject to the approval of the Chief Fire Prevention Engineer, shall be provided and installed in every theater.

(b) The supports and installation of all tanks used to supply water to such system of standpipes and such automatic sprinkler system shall be subject to the approval of the Commissioner of Buildings.

626. Ice Making Machinery—Prohibition of.) It shall be unlawful to install any machinery or compressors of any description to be used in conjunction with ammonia in the manufacture of artificial ice in the auditorium or stage parts of any building of Class V, and it shall be unlawful to convey ammonia or to install any piping for the conveying of ammonia into any building of Class V for the purpose of manufacturing artificial ice from any machinery or compressors situated outside of any building of Class V.

627. Lighting Service Requirements—Gas or electricity or both may be used for illuminating purposes in buildings of Class V hereafter erected. Gas shall not be used in that part of the building known as the stage side of the proscenium wall. Provisions shall be made to properly light every portion of a building of this class and every outlet therefrom leading to the outside of the building and all open courts, passageways and emergency exits. Lights in vestibules, halls, corridors, passageways, stairways and other

means of egress from the building and premises shall be on an independent circuit or service and shall be controlled separately and exclusively by a switch or shutoff located near the main entrance. In rooms, halls and auditoriums used for the purposes of this class, provisions shall be made to furnish a light supplied by gas and a light supplied by electricity above if possible, otherwise closely adjoining every opening to an exit or to an emergency exit from the room, hall or auditorium.

The light furnished by gas as required by the provisions of this section above or adjacent to an exit or exits may be omitted if in lieu thereof a light supplied by electricity furnished by storage battery system or by a motor generator and service battery system is installed. Said lights, motor generator and battery system shall be approved by the Commissioner of Gas and Electricity, and shall be installed and operated in compliance with the rules of the Department of Gas and Electricity.

Amendment of July 15, 1924.

628. Dressing Room Partitions.) Partitions forming dressing rooms shall be constructed of incombustible material, and such dressing rooms shall be properly ventilated as in the judgment of the Commissioner of Health may be required.

629. Capacity—Certificate for License.) (a) The Commissioner of Buildings shall determine the number of persons which each room used for the purpose of Class V may accommodate according to the provisions of this chapter, and shall certify the same to the City Clerk. No more than the number so certified shall be allowed in such room at any one time.

(b) Before a license shall be issued for the operation of a building of Class V as a theater the Commissioner of Buildings shall first certify, in writing, that such theatre complies with the provisions of this chapter in every respect.

630. Scenery—Definition—Movable Scenery.) (a) "Scenery" as used in this chapter shall include all scenery, drop curtains, borders and wings which are constructed or made of cloth, canvas or combustible material, whether stationary or movable.

(b) "Movable Scenery" shall include all scenery, drop curtains, borders, and wings which are made movable for the purpose of changing an entire set of scenery and substituting another set during or between the various stage acts.

(c) No combustible material other than painted decorations shall be applied to the walls, ceiling or curtain of an audience room in any building of Class IV or V. This prohibition, however, shall not apply to the case of an entertainment of a spectacular character given in a public theater of Class V having a seating capacity of three thousand or more where all other scenery except such scenery necessary in such spectacular performance is removed from the stage, and where it is necessary for the complete presentation of the entertainment to modify the appearance of the proscenium walls and arch, and the walls of the auditorium, on either or both sides thereof, and to extend the stage into the audience room as hereinafter specified so as to make the whole appear to be part of a church, cathedral or other place of worship, such proposed modifications to be immovable and permanent during the period of time in which the spectacle is to be presented in the said theater. In such modifications, however, the added parts must be composed either of non-combustible material, or if composed of combustible materials such material must be thoroughly treated as often as may be required with a fire-proofing solution which shall render the material non-

inflammable, satisfactory to the Chief Fire Prevention Engineer. Such modifications shall not be more than fifty-four (54) feet high, the stage part thereof shall extend not more than seventeen (17) feet in front of the proscenium wall of such theater, and the other parts thereof shall extend not more than thirty-eight (38) feet beyond either side of the proscenium arch of such theater. If any such extension of the stage is made into the audience room it shall be approached on the audience side thereof by a series of steps constructed across the greater portion of its breadth, such steps to be each not more than seven (7) inches in height and eleven (11) inches in depth. Such modifications are to be so constructed as in no way to interfere with the free action of the steel or other fireproof curtain or curtains in such public theater. All details of construction in connection with such modifications shall be subject to the approval of the Commissioner of Buildings of the City of Chicago. No such modifications, however, shall be permitted to be maintained after the conclusion of such spectacular engagement, and at the conclusion thereof such modifications shall be removed from such theater and the said theater be placed in substantially the same condition that it was prior to the installation of said modifications. During every performance or display in any such public theater, such theater shall employ and maintain in and about the close vicinity of such modifications at least one retired uniformed city fireman for each five hundred persons in the seating capacity of such theater or part thereof, said fireman to be instructed and drilled by, and be under the supervision of the Chief Fire Prevention Engineer, and said firemen shall have in such theater such portable or temporary fire extinguishing apparatus as may be designated by the Chief Fire Prevention Engineer.

631. Changing from Class IV to Class V.) Whenever an existing Class IV theatre is changed into a Class V theatre, the same shall be made to comply with all of the provisions for Class V theatres hereafter erected.

ARTICLE IX.

Class VI.

632. Class VI Defined.) In Class VI shall be included every tenement and apartment house or building or portion thereof, which is used or intended to be used as a home or residence for two or more families living in separate apartments.

633. Requirements—General.) Every building of Class VI shall comply with the general provisions of this chapter, and in addition to the general provisions shall comply with the following special provisions:

634. Definition of "Existing Tenement,"—"New Tenement"—"Apartment"—"Yard"—"Court"—"Shaft"—"Public Hall"—"Stair Hall"—"Basement"—"Cellar"—"Story"—"Solid Masonry".) (a) "New Tenement house" shall include every tenement, flat and apartment house erected after December 17, 1902, and every tenement house which shall hereafter be increased or diminished in size or otherwise altered after its erection and every building now or hereafter in existence not now used as a tenement house but hereafter converted or altered to such use. "Existing tenement house" shall be construed to mean a flat or apartment house built prior to December 17, 1902.

(b) "Apartment" is a room or suite of two or more rooms occupied or intended or designed to be occupied as a family domicile.

(c) "Yard" is an open unoccupied space on the same lot with a tenement house, separating every part of every building on the lot from the rear line of the lot.

(d) "Court" is an open, unoccupied, unobstructed space, other than a yard, on the same lot with a tenement house; a court entirely surrounded by a tenement house is an "inner court"; a court bounded on one side and both ends by a tenement house, and on the remaining side by a lot line is a "lot line court"; a court extending to a street, alley or yard is an "outer court."

(e) "Shaft" includes exterior and interior shafts, whether for air, light, elevator, dumb waiter or any other purpose; a "vent shaft" is one used solely to ventilate or

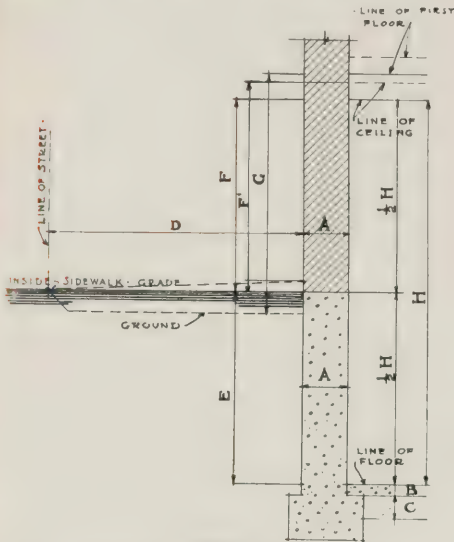


Fig. 9.

DEFINITION OF BASEMENT, ETC. Sec. 634

- (H) Height of basement (floor to ceiling).
 (D) Distance from street line nearest the building.
 (E) Distance below sidewalk grade.
 (F) Distance above sidewalk grade.

Explanation:

Basement is a story partly but not more than $\frac{1}{2}$ below ($\frac{1}{2}$ H) the level of the inside sidewalk grade. If floor of basement is less than 2 ft. (E) below such grade, or if ceiling of such basement is more than 7' 6" (F) above said grade, said story shall be classed as first story.

(F) For every foot of (D) F may be raised not more than 1-3", as at (F').

(G) Equals distance from ground to line of first floor.

Ex. for yard ground levels or walks or other improvements for a distance of 12' 0" at every point from all outside walls. (G) shall not be lower than 8' 3".

Sec. 659

(A) Not to be less than 12". (See Sec. 506 for exceptions).

(B) 3" thickness of floor required.

(C) 6" sand or clinders required.

light a water closet compartment, bath room, or pantry.

(f) "Public Hall" is a hall, corridor or passageway not within an apartment.

(g) "Stair Hall" includes the stairs, stair landings and those portions of the public halls through which it is necessary to pass in getting from the entrance floor to the top story.

(h) "Basement" is a story partly, but not more than one-half below the level of the inside sidewalk grade of the street nearest the building. If the floor of such basement is less than two feet (2 ft.) below such grade or if the ceiling of such basement is more

than seven feet, six inches (7 ft. 6 in.) above said grade, said story shall be classed as the first story of the building in which it occurs. Provided, however, that the ceiling height may be raised above the height of seven feet, six inches (7 ft. 6 in.) heretofore given, not more than one-third of an inch for every foot of such distance said building is set back from the street line of the street nearest the building, but in no case shall any rise of ceiling be allowed for any distance beyond thirty feet (30 ft.) said building may be set back from the line of the street nearest the building, and in such cases all rises in the basement ceiling shall be computed according to the distance between the street line and the outside wall of the building nearest to said street line. Provided further, that the yard or ground level, or walks, or other improvements thereon for a distance of twelve feet (12 ft.) at every point from all outside walls of said building shall not be lower than eight feet three inches (8 ft. 3 in.) below the floor level of the first story of said building.

(i) "Cellar" is a story more than one-half below the level of the inside sidewalk grade of the street nearest the building.

Where the grade of a street adjacent to a tenement house varies, the average grade of such street opposite the lot containing the tenement house shall be regarded as the grade of such street within the meaning of this chapter.

(j) "Story" is that portion of a building between the top of any floor beams and the top of the floor or ceiling beams next above.

635. Where Sections of This Article Conflict With Other Sections. In cases of direct conflict with the provisions of other sections of this ordinance relating to other classes, or of sections in other articles of this chapter, the provisions of the sections in this article relating to Class VI shall govern in respect to tenement houses.

636. Changes or Alterations—Permits. Every new tenement house and every change or alteration in any existing tenement house shall conform to the requirements of this chapter. No new tenement house shall be begun, nor shall any changes or alterations in any existing tenement house, such as are referred to in this chapter, be begun until a permit therefor shall have been issued by the Commissioner of Buildings. Such permit shall be issued only upon an application by the person, firm or corporation for whom the building is to be erected or altered, and after approval of the plans and specifications for such tenement house or for such changes or alterations by the Commissioner of Health whenever such approval is required by the ordinances of the City of Chicago.

637. New Tenement House—When to be Occupied. (a) No new tenement house shall be occupied in whole or in part for human habitation until the issuance of a certificate by the Commissioner of Health that said building conforms to the requirements of this chapter relative to light and ventilation, plumbing and drainage applicable to said buildings, nor until the issuance by the Commissioner of Buildings of a certificate that the said building conforms to the requirements of this chapter relative to fire escapes and means of egress applicable to new tenement houses. Within five days from date of application for any certificate above mentioned, such certificate shall be issued or the official concerned shall state in writing his reasons for his refusal to issue said certificate.

(b) The certificate above referred to may be issued in the case of a new tenement building comprising more than three apartments so as to allow the occupation of any section of the building extending from cellar to roof in advance of the completion of the other portions of the building.

(c) When the outer walls of a new tenement house have been erected so as to outline the position of the courts and shafts required for the lighting and ventilation of habitable rooms, the owner of the building or his representatives shall be entitled, upon application in writing, to an inspection of the same by the Commissioner of Buildings, and if the work to that point is in compli-

distant more than fifty feet from such junction shall not be regarded as part of a corner lot, but shall be subject to the provisions of this chapter respecting other than corner lots. Where, in corner lots, the two frontages are of unequal length, the lesser street frontage shall be taken as the width of the lot. Street frontage alone, and not alley frontage shall be considered in determining such lesser frontage.

640. **Height—How Measured.** (a) The height of a new tenement house shall not exceed by more than one-half the platted width of the widest street on which it abuts, and no existing tenement house shall be increased beyond such height.

(b) Provided, however, that any distance the building sets back from the lot line shall be added to the width of the street in making this computation. Such height shall be the perpendicular distance from the inside sidewalk grade of the street nearest the building to the highest point of the external bearing walls and shall not include any cornice or bulkhead less than eight feet high or any elevator enclosure less than sixteen feet high. Where such street grade varies, the mean or average grade thereof opposite such building shall be the data from which such height is measured.

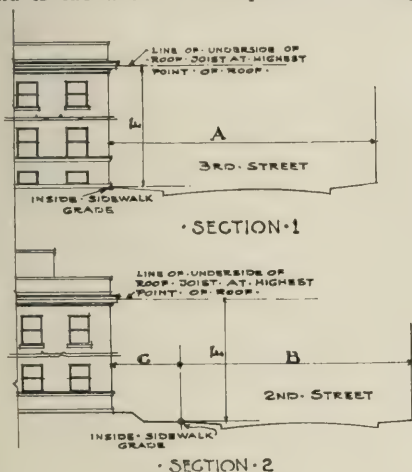


Fig. 10.

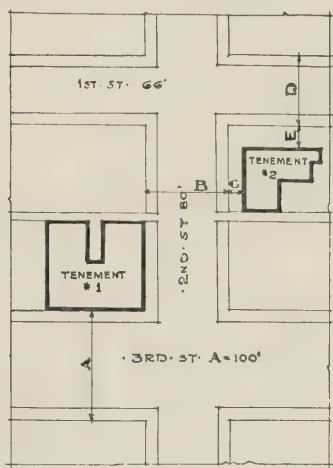
ance with the provisions regarding the size of shafts and the location of the building, to a certificate setting forth those facts.

(d) When the work of constructing partitions has advanced to a degree on any floor, that the rooms on that floor are determined in their dimensions, the owner or his representatives shall be entitled to an inspection from the Commissioner of Buildings, and if the rooms thus outlined conform in their dimensions to the plans filed and to the requirements of this chapter, he shall be entitled to a certificate stating that fact.

(e) If a new tenement house is occupied as a place of habitation in any of its parts in violation of this section, it shall forthwith be subject to notice from the Commissioner of Buildings and shall be vacated upon such notice and shall not again be occupied until made to conform with the provisions of this chapter nor until after the issuance of the two certificates required in this section.

638. **Plat to be Filed.** At the time of applying for a permit for the erection of, alteration of, addition to or moving of a tenement house or for the erection, alteration, adding to or moving of any building upon a lot upon which a tenement house stands, the applicant shall submit to the Commissioner of Buildings a plat of the lot, showing the dimensions of the same and the position to be occupied by the proposed building or by the building to be altered or added to or by the building to be moved thereon, and the position of any other building or buildings that may be on the lot. The measurements shall in all cases be taken at the top of the first story and shall not include any portion of any street or alley.

639. **Corner Lot Defined—Frontages.** By "corner lot" is meant a lot situated at the junction of two streets or of a street and a public alley at least sixteen feet wide, provided that if such alley be less than sixteen feet wide, and the lot be estimated on a line sixteen feet from the opposite side of the alley, such lot may be considered a corner lot. Any portion of the width of such lot



PLAN.

Fig. 11.

SECTION 640 a b.

Height of Tenement House; How Measured.

A—width of widest street (in this case 3rd St.) on which tenement house No. 1 abuts.

B—width of widest street (in this case 2nd St.) on which tenement house No. 2 abuts.

C—distance tenement house No. 2 sets back from 2nd St.

D—width of 1st St., other street on which tenement house No. 2 abuts.

E—distance tenement house No. 2 sets back from 1st St.

F—allowable height, which in this illustration is measured as shown by the perpendicular distance from the inside sidewalk grade of the street nearest the building, to the highest point of the external bearing walls. For exceptions, where elevator enclosures and cornices or bulkheads are used, see section 640 b, last paragraph.

Explanation:

F—tenement house No. 1 shall not exceed $\frac{1}{2}$ A.
F—tenement house No. 2 shall not exceed $\frac{1}{2}$ (B+C) unless $\frac{1}{2}$ (D+E) is greater than $\frac{1}{2}$ (B+C). Then F shall not exceed $\frac{1}{2}$ (D+E).

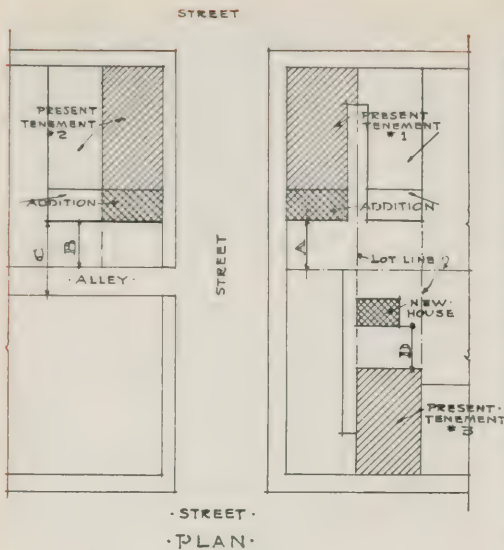


Fig. 12.

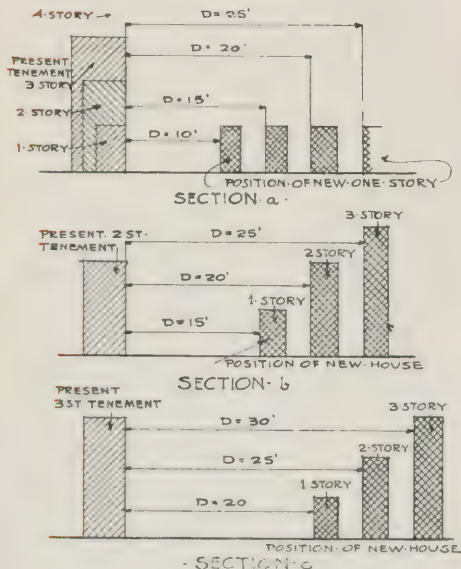


Fig. 13.

SECTION 641

A—distance from rear line of addition, to present tenement house No. 1, to rear line of lot.

B—distance from rear line of addition, to present tenement house No. 2, to rear line of lot, abutting public alley.

C—distance from rear line of addition, to present tenement house No. 2, to opposite side of such alley.

D—distance from present tenement house No. 3, standing on an inner lot, to new building.

Explanation:

A shall not be less than 10 ft. either by addition to, or diminishing present tenement house No. 1.

If B is less than 10 ft., then C must not be less than 16 ft. Sections a, b, c, are explanatory diagrams of different cases of required distances D, between tenement house No. 3 and new house. Exception to this rule is stated in last paragraph of Section 641.

641 Distance Between Buildings.) No existing tenement house shall hereafter be enlarged or its lot be diminished, so that the rear line of any building on such lot approaches nearer than ten feet to the rear line of the lot, unless the rear of the lot upon which it stands, abuts upon a public alley, in which case the rear line of such building shall be not less than sixteen feet from the opposite side of such alley. Where a tenement house, now existing or hereafter erected, stands upon a lot other than a corner lot, no other building shall hereafter be placed upon the front or rear of that lot, unless the minimum distance between such buildings be at least ten feet, if neither building exceeds the height of one story; or fifteen feet, if either building exceeds the height of one story, but not the height of two stories, and so on, five additional feet to be added to such minimum distance of ten feet for every story more than one, in the height of the highest building on such lot; Provided, that a one-story building without basement, and not used for habitation, may be placed on the rear of a lot containing a tenement house, if a minimum distance of ten feet is maintained between every point of such building and the tenement house.

642. Percentage of Area Allowed to be Covered.) No existing tenement house shall hereafter be enlarged nor its lot be diminished, nor other buildings be placed on its lot, nor a tenement house be moved on a lot on which there is an existing building, so that after such change a larger proportion of any corner lot or other lot upon which it is situated is covered by buildings, than the following proportions, respectively: No new tenement house alone or with other buildings now or hereafter erected, shall occupy above the first story more than eighty-five per centum of the area of a corner lot, provided that in the case of a fireproof building, in which the windows of every habitable room open directly on a street, the portion of the lot covered may be ninety per centum of the area of said lot, subject to the requirement that a ten foot space must be left above the first story opposite the lesser frontage; or more than ninety per centum of the area of such corner lot if such corner lot is bounded on at least three sides by streets or alleys; or more than seventy-five per centum of the area of any other lot, except that the space occupied by fire escapes, constructed and erected according to law and not more than four feet wide, shall be deemed unoccupied. Provided, however, that in case of a lot, triangular or irregular in shape bounded on two or more sides by a street and having a number of lineal feet street frontage exceeding one-twentieth of the number of square feet in the area of such lot, it shall not be necessary to comply with the conditions of this section as to percentage of lot which may be covered.

643. Must Have Alley or Yard in Rear—Size of Yard Increased.)

At the rear of every lot containing a tenement house, there shall be a yard open and unobstructed from the earth to the sky, except by fire escapes not more than four feet wide, constructed and erected according to law, unless the rear of such lot abuts upon a public alley at least ten feet wide, in which case the rear line of such building shall be not less than 16 feet from the opposite side of such alley; every part of such yard shall be directly accessible from every other part thereof; such yard shall have an area of at least eight per centum of the superficial area of the lot on corner lots except as otherwise provided in this section; and on other lots, such yards shall have an area of at least ten per centum of the superficial area of the lot. Every such yard shall be increased one per centum of the superficial

area of the lot for every story above three stories in height of the tenement house situated thereon.

644. **Courts—Inner—Outer—Lot Line.)** (a) "Inner courts" of all new tenement houses as defined in Section 634 of this ordinance, shall have minimum widths at every point and minimum areas as follows:

Courts— Height of	Least width in feet.	Least area in square feet.
1 story	6.....	100
2 stories	6.....	120
3 stories	8.....	160
4 stories	8.....	160
5 stories	12.....	260
6 stories	16.....	400
7 stories	20.....	625
8 stories or more.	24.....	840

(b) The height of a court shall be the number of stories having habitable rooms with windows in its walls.

(c) "Outer courts" and "lot line courts" of all new tenement houses as defined in Section 634 of this chapter shall have minimum widths at every point equal to one-half of the minimum widths required by this section, and lot line courts shall have minimum areas equal to one-half of the minimum areas required herein for "inner courts." If an outer court or lot line court has windows on opposite sides, its minimum width shall conform to the width given in the table.

(d) The minimum widths hereinbefore specified for outer courts and the minimum widths and areas specified for lot line courts are to be provided irrespective of the presence of or dimensions of courts on other premises bounded by the same lot line.

(e) Every "inner court" and every "lot line court" of every new tenement shall be connected directly with a street, alley, yard, or outer court by an opening extending from grade at the building to a height of at least fifteen feet, and kept unobstructed save by an openwork grill or gate, such opening to be at least two feet wide for an inner court and one foot wide for a lot line court. In case of a three-story tenement on a lot twenty-five feet or less in width, a continuous lot line passage open to the sky, and six inches in width, shall be accepted for the opening specified above as one foot wide for a lot line court. If such inner court or lot line court starts from any point above finished grade at building, such starting point shall be considered as grade for purpose of determining the location of the opening to outer air herein specified.

(f) In case of a three-story tenement on a lot of twenty-five feet or less in width a continuous lot line passage open to the sky, and at least three feet wide, shall be accepted in lieu of a lot line court or outer court hereinbefore specified in Paragraph (a). In case of a three-story tenement on a lot thirty feet or less but more than 25 feet in width, a continuous lot line passage open to the sky, and at least three feet six inches wide shall be accepted in lieu of a lot line court or outer court hereinbefore specified in Paragraph (a).

(g) In case of a two-story tenement on a lot twenty-five feet or less in width, a lot line court having an area of at least fifty square feet shall be accepted in lieu of a lot line court heretofore specified in Paragraph (a) of this section, and in case of a three-story tenement on a lot of twenty-five feet or less in width, a lot line court having an area of at least sixty square feet shall be accepted in lieu of a lot line court hereinbefore specified and required by Paragraph (a) of this section.

(h) In case of two or three-story tenement

buildings on lots twenty-five feet or less in width, where there is only one apartment on each story containing not more than four rooms in such apartment, the light courts hereinbefore specified in Paragraph (a) may be omitted, provided there is a continuous passageway open to the sky and not less than three feet wide on one side of said building.

645. **Vent Shafts—Area Of.)** (a) "Vent shafts" of all new tenement houses, as defined in Section 634 of this ordinance, shall have minimum widths at every point and minimum areas as follows:

Height of Vent shafts	Least width in feet	Least area in square feet.
1 story	3.....	21
2 stories	3.....	22½
3 stories	3.....	27
4 stories	3.....	36
5 stories	5.....	48
6 stories	6.....	72
7 stories	8.....	96
8 stories or more.	8.....	120

(b) Every such vent shaft in every new tenement house more than two stories high, shall be connected directly with a street, alley, yard or court by one or more horizontal ducts or intakes at a level not lower than the finished grade of building nor higher than second story floor; the total area of such ducts to be not less than three per cent of the area of such vent shaft, and no single duct to be of less area than one hundred square inches; such total and individual duct area shall be net over and above all obstructions.

646. **Stair Hall and Shaft—Well-Hole Dimensions.)** (a) Every public stair hall in every new tenement house shall, for each story, have a window of an area of at least twelve square feet, opening directly on a street, alley, yard or court; or on a shaft of minimum area, as hereinafter provided; or shall have an unobstructed vertical well-hole of the following minimum area at each floor line above the first, and, directly over such well-hole, there shall be a skylight or twice the following minimum area:

Building— Height of	Least area in square feet of stair shaft or well hole.
2 stories—if there is more than one apartment on a floor.....	8
3 stories—if there is more than one apartment on a floor.....	13
4 stories	19
5 stories	25
6 stories or more.....	38

(b) Such window, if any, shall be so placed that light may pass directly to the opposite end of the hall, or else there shall be at least one window opening directly upon a street, alley, yard or court in every twenty feet in length or fraction thereof of such hall, except in so much of any entrance hall as lies between the entrance and the flight of stairs nearest the entrance. In any such public hall, recesses or returns, the length of which does not exceed twice the width of the hall, will be permitted, without an additional window, but, otherwise, each recess or return shall be regarded for the purposes of this section as if it were a separate hall. Any part of a public hall which is shut off from any other part by a door or doors shall be deemed a separate public hall within the meaning of this section.

(c) Skylights shall be ventilating skylights and shall have over them a wire netting mounted on wire frame and 6-inch iron legs, of wire not lighter than No. 12 and with mesh not coarser than one inch by one inch, unless constructed of wired glass or prismatic light glass.

647. Rooms—Size and Height Of—Attic Rooms.) (a) In every new tenement house, all habitable rooms shall be of the following minimum sizes:

(b) In each apartment, there shall be at least one room containing not less than one hundred twenty square feet of floor area, and every other room shall contain at least eighty square feet of floor area, provided, however, that in the case of a room having a window not less than eighteen feet in area opening upon a public street, the floor area need not be greater than seventy feet. Each room shall be in every part not less than eight feet six inches high from the finished floor to the finished ceiling; provided, however, an attic room need be eight feet six inches high in but one-half of its area, in case there are not less than 750 cubic feet of air space therein.

648. Alcoves and Alcove Rooms.) (a) For the purpose of buildings of Classes III and IV, an alcove shall be defined as a recess connected with or at the side of a larger room. The floor of such an alcove shall be counted as a part of the floor area and its cubic contents as a part of the cubic contents of the room with which it is connected.

(b) In every new tenement house every alcove shall be deemed a separate room for all purposes within the meaning of this chapter, except an alcove that has a floor area of not to exceed thirty-five square feet and that has an unobstructed opening, equal in area to twenty per centum of its entire wall surface, into an adjoining habitable room; provided that in constructing additional habitable rooms by raising or altering existing one story dwellings, the limitation of the floor area of an alcove may be disregarded, provided such alcove has an unobstructed opening, equal to the floor area of such alcove, into an adjoining habitable room.

(c) This section shall not be construed as forbidding the erection of pilasters or other decorative effects projecting not more than eighteen inches from the plane of the wall of a habitable room.

(d) No part of any room in a tenement house shall be enclosed or sub-divided at any time, wholly or in part, by a curtain, portiere, fixed or movable partition or other contrivances or device, unless each part of the room so enclosed or sub-divided shall contain a separate window as herein required, and shall have a floor area of not less than 80 square feet as herein required for habitable rooms, except as heretofore provided in this section.

649. Air—Quantity of for Each Person.) No room in any tenement house shall be occupied so that the allowance of air to each adult person living or sleeping in such room shall at any time be less than four hundred cubic feet or less than two hundred cubic feet for each person under twelve years of age.

650. Habitable Rooms—Bath Rooms—Panties—Requirement as to Ventilation and Lighting.) (a) In every new tenement house every habitable room shall have a window or windows with a total glass area equal to at least one-tenth of its floor area opening onto a street, alley, yard or court. None of such required windows shall have a glass area of less than ten square feet, and each such window shall have its top not less than even feet above the floor and shall be so constructed that at least its upper half may be opened its full width.

(b) In every new tenement house every bath room, water closet, or urinal compartment shall have at least one window with a glass area of at least six square feet and a minimum width of one foot, opening upon a street, alley, yard, court or vent shaft.

(c) In every new tenement house every

pantry shall have at least one window of not less than six square feet in area, with a width of not less than one foot, opening into a street, alley, yard, court or vent shaft, which vent shaft shall be at least six square feet in area.

(See Illustration Sec. 470B.)

651. New Tenements—Habitable Rooms in Basements—Prohibited in Cellars.) In no new tenement house shall any room in the cellar be constructed, altered, converted or occupied for living purposes; and no room in the basement of a new tenement house shall be constructed, altered, converted or occupied for living purposes unless such rooms shall be at least eight feet six inches high in the clear and shall have at least one-half of such height above the finished grade of said premises at the building, and at least four feet three inches of such height above the average street grade at the building.

652. Tenement Houses—Requirements for Fireproof and Slow-burning Construction.) Every new tenement house more than five stories and basement high shall be of fireproof construction. Every new tenement house more than three stories and basement high, but not more than five stories and basement high shall be of slow-burning or fireproof construction. In case slow-burning construction be required, the cellar and basement construction, including the floor construction of the first story above the cellar or basement, shall be of fireproof construction.

653. Frame Tenement—Requirements.) In every new frame tenement house outside the fire limits, each suite of apartments shall be separated from the next suite in such building by a partition of four-inch tile or of metal studding and metal lath, and the enclosing walls around the stairs, where there are two or more apartments on a floor, shall be of fireproof construction or of solid masonry of the same dimensions as are required by Section 732.

654. Frame Additions to Frame Tenement Houses Within Fire Limits Not Permitted—removal of Frame Tenement Houses.) No frame addition shall be permitted to any frame tenement house within the fire limits, either by adding to its height or its superficial area.

If a tenement house, standing on wooden supports, is moved to another lot, it shall not again be placed on wooden supports, but shall be placed on a masonry or concrete foundation.

If a frame tenement house, not more than two stories high, is moved from one location to another upon the same lot, it may be set upon wooden posts and a basement or cellar not to exceed six feet six inches in height from the floor to the ceiling thereof may be maintained thereunder, and no habitable rooms shall be constructed or occupied in said basement or cellar.

655. Entrance Halls—Solid Masonry—Exceptions—Ceilings.) Every main entrance hall in a new tenement house shall be at least three feet six inches wide in the clear from the entrance up to and including the stair enclosure and beyond this point at least three feet wide in the clear. In every new non-fireproof tenement house, except where there be only one apartment on each floor, such entrance hall shall be inclosed with solid masonry walls and with ceilings covered with incombustible material and shall comply with all the conditions of the following sections of this ordinance as to the construction of stair halls. If such main entrance hall is the only entrance to more than one flight of stairs, the several portions of such main entrance hall which separate the entrance of the building from the several flights of stairs, respectively,

shall be increased respectively at least one foot in width for each additional flight of stairs.

656. Stair Halls—Construction of—Hand-rails.) (a) The stairs and stair halls in all new tenement houses more than three stories and basement or cellar high shall be constructed of incombustible material throughout, except that the treads of stairs may be of wood not less than one and three-eighths inches thick and all handrails may be of hardwood.

(b) In every new non-fireproof tenement house all stair halls shall be enclosed on all sides with walls of solid masonry of the dimensions required by Section 732. All windows in stair halls, except where same open into a street, alley, outer court, or yard, shall have metal frames and sashes, glazed with wired glass. This section shall not apply to tenement houses which are not more than three stories and basement high with only one apartment on each floor. Where the main entrance vestibule and entrance hall or corridor of said building, including the floor and ceiling thereof, are of fireproof construction as defined in this chapter, from the outside face of the building at said entrance to and including the floor of

stair hall, and all doors leading therefrom or thereto except the street doors are fire retarding doors, the floor of said entrance and vestibule may be built at a level of two inches (2 in.) above the level of the outside grade of the building at the entrance of same, without changing the definition of the word "Basement" with regard to height of floors, as contained in Section 634.

(See Illustration Sec. 613.)

657. Apartments Divided by Masonry.)

(a) There shall be a wall of solid masonry of thickness as required by Section 732 extending from the ground to the roof between each set of apartments and around each court and each light shaft, except as hereinafter provided; (1) provided, however, that a wall between apartments and extending from the main stair hall to the outer wall of the building may be offset at the second story floor line to some point nearer the center of the building, or of the group of apartments, to admit of an even distribution of space in the rooms adjacent to such wall, if such wall is supported at the second story floor line on fireproofed steel or iron beams which extend from the brick wall surrounding the main stair hall to the outer wall of the building; and provided, further, that such offset wall may be reduced to the thickness of eight inches, if supported at each floor line above the first story on fireproofed steel or iron beams carried by masonry walls as above specified; (2) and provided, that, in case there is a store or stores in the first story of a building of this class, a masonry dividing wall between apartments may begin at the second story floor line, if such dividing wall is supported on fireproofed steel or iron beams carried by masonry; and provided, further, that such dividing wall may be reduced to the thickness of eight inches, if supported at each floor line above the first story on fireproofed steel or iron beams carried by masonry. In buildings of fireproof construction the partitions between apartments, and around stairs may be of burnt clay tile not less than three inches in thickness or reinforced concrete partitions not less than three inches in thickness.

(b) In buildings of ordinary construction two separate thicknesses of metal lath and fire-resisting plaster shall be used as fireproofing as required by this section.

658. Ceiling Over Stores—Courts and Shafts Beginning Above First Story.) (a)

In every new non-fireproof tenement house in which there is a store or stores in the first story, if the building is three stories or less in height, the portions of the first story ceiling directly under all public halls shall be of slow-burning construction, and if the building is four or more stories in height the entire basement and first story construction and the second story floor construction shall be of fireproof construction.

(b) In every new non-fireproof tenement house the masonry walls enclosing every court or light or vent shaft beginning above the first story shall be supported on fireproofed steel or iron beams carried by masonry or by fireproofed steel or iron columns; and such court or shaft enclosing walls may be reduced to the thickness of eight inches if supported at every intersecting floor line on fireproofed steel or iron beams carried as above specified.

659. Damp-Proofing—Basement Wall to Be Masonry—Cement Floor.) In every new tenement house constructed of brick or frame, the foundations and basement walls shall be built of masonry or concrete not less than twelve inches in thickness, except as provided in Section 732 and shall have all outside walls below the adjacent ground level plastered on the outside with Portland cement or treated with other ap-

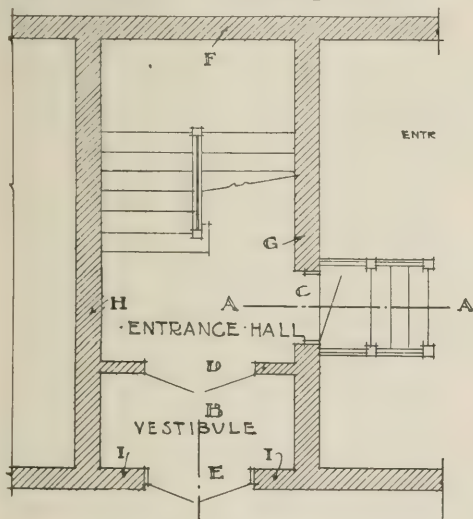


Fig. 14.

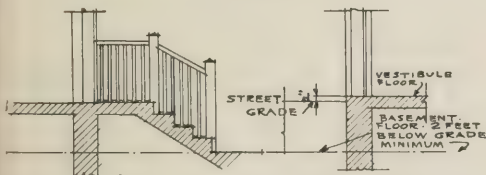


Fig. 15.

SECTION 656 B.

Beginning, where the main entrance vestibule, etc. If walls F H G I, also floor and ceiling of entrance hall A, and floors and ceiling of vestibule B, are of fireproof construction, and door C is a fireproof door with fireproof frames, the vestibule B may be built 2" above level of outside grade without changing the definition of the word "basement"—see section 634.

Doors E and D do not have to be fireproof—see section AA and BB for condition at hand.

proved damp-proofing material, and such walls, as high as the ground level, shall be laid in cement mortar. The basement or cellar of every existing and new tenement house shall have a floor of Portland cement concrete not less than three inches in thickness laid on not less than six inches of sand or cinders.

(See Illustration Sec. 634.)

660. Bay Windows—Courts—Vent Shafts.) (a) The walls of every bay window and every court in masonry constructed new tenement houses shall be built of brick or other fireproof construction as required for exterior walls.

(b) The walls of every interior vent shaft in masonry constructed tenement houses shall be built of masonry or of fireproof material not less than four inches in thickness, supported by steel or iron.

661. Porches.) (a) Where porches are constructed in courts of now existing or new tenement houses, the amount of area of unobstructed space in such courts shall be exclusive of space occupied by stairs and porches. No additional rear porch shall be constructed on any existing tenement house in such way that the buildings on the lot with all their porches shall occupy a greater proportion of the lot than is permitted in Section 642 of this chapter. No rear porch on any existing tenement house where the total area of buildings and all porches exceeds the proportion of the lot permitted in Section 642 of this chapter shall be reconstructed until the plan for such reconstruction shall have been submitted to and approved by the Commissioner of Buildings. No rear porch built of combustible materials and more than eight feet in width, excepting stairways, shall be constructed on any new tenement house nor added to, nor reconstructed on any existing tenement house.

(b) Front porches of buildings in existence at the time of the passage of this ordinance may be enclosed temporarily from the first day of November in each year to the first day of the following May with wood sash glazed with ordinary glass; provided that the glass area shall be as large as is consistent with good construction and the ordinances of the city; and further provided, that the sashes are fitted with hinges or hung in such a manner as to allow them to open at least one-half of their area, or that one-half of all the sash installed are so fitted or hung as to open their entire area, and the area of such open sash shall be at least twice the area of all windows from adjacent rooms opening on to porches so enclosed, unless such room adjoining said porch shall have windows opening on to a street, alley, yard or court of proper legal dimensions as required by this chapter for habitable rooms in addition to the windows opening on to the porch, in which case the amount of movable sash in porch enclosure shall be not less than ten per cent of the floor area of said porch and in no case less than ten square feet of glass area.

(c) Rear porches and side porches of buildings in existence at the time of the passage of this ordinance, where every part of said porch is at least ten feet distant from any other building, porch or structure located upon the same lot with the building of which such porch is a part, may be enclosed temporarily from the first day of November in each year to the first day of the following May with wood sash glazed with ordinary glass; provided, that the glass area of the enclosure shall be as large as is consistent with good construction and the ordinances of the city; and further provided, that the sashes are fitted with hinges or hung in such a manner as to allow them to open at least one-half their area, or that one-half of all the sash installed are so fitted or hung as to open their entire area, and in

no case shall be less than three times the area of all windows, doors and transoms opening on to said porch, and that in every case the top of the sash in such enclosure shall be at least six inches higher than the top of the windows and doors opening on to such porch. The framing of the porch enclosure may be of wood, and the glass area of each side and of each end of such porch shall be not less than fifty per cent of the entire side or end of such porch enclosure measured from the floor of the porch to the under side of joists immediately above such porch in each story.

(d) In every building erected after the passage of this ordinance, every front porch, rear porch or side porch which is intended to be enclosed must have enclosing walls as required by the ordinances of the city for enclosing walls of a building of the type of which said porch is a part, and every porch so enclosed shall be considered a separate habitable room and shall comply with all the requirements of this chapter for habitable rooms, and such porch enclosure shall not in any manner intercept the light or the ventilation of any adjoining room.

(e) Where buildings do not exceed three stories in height the stairways in rear porches may be partially enclosed as follows; the end of the porch outside the stairway, also the back of the porch around said stairway not to exceed eleven feet in extent, may be enclosed with wood or frame construction and a window with glass area of nine square feet shall be placed in the back enclosure or in that part of the porch facing the yard or court on each story.

662. Flues and Chimneys.) In every building used for the purposes of Class VI, the flues or chimneys shall conform to the following regulations: For one stove opening, the flue area shall be not less than forty-nine square inches. For more than one stove opening and one furnace opening, the flue area shall be not less than seventy-seven square inches. All such flues shall be constructed according to the requirements of Section 800 of this chapter.

663. Bulkhead in Roof—Construction of—When Required.) There shall be in the roof of every new tenement house, unless the pitch of the roof thereof exceeds one foot rise in four foot run, at least one bulkhead or scuttle, fireproof or covered with fireproof material, with stairs or ladder leading thereto; no such roof opening shall be less than two feet by three feet. Where such tenement house is provided with rear stairs, there shall be a bulkhead or scuttle accessible from each of such rear stairs. No scuttle or bulkhead door shall have any lock on it but may be fastened on the inside by movable bolts or hooks.

664. Stairways—Width and Construction of—Handrails.) (a) Every now existing and every new tenement house shall have at least two flights of stairs, which shall extend from the entrance floor to the top story, and which stairs shall be as far apart as practicable. One of said stairways shall be an interior stairway. Such stairs and the public halls in every tenement house shall each be at least three feet wide in the clear, and every apartment shall be directly accessible from both such flights of stairs without going through any other apartment. An apartment whose gross floor area does not exceed 1,000 square feet and having not to exceed six habitable rooms in an existing tenement house and which at the time of the passage of this ordinance had not access to two stairways, may have exit to a second stairway through another apartment, providing the door between the two apartments is equipped with a glass panel not less than five feet high and twenty inches wide, with the bottom of same not

less than eighteen inches above the floor. Or where the floor level of said apartment is not more than twelve feet above the surface of the yard or ground surrounding the building, a balcony with an area not less than eighteen square feet equipped with a drop ladder to the ground may be attached to the outside wall of said building accessible by a door or window from such apartment. Such glass panel, door or balcony and ladder, as the case may be, shall be considered as a secondary means of exit from said apartment, if in the judgment of the Commissioner of Buildings such glass panel door, balcony and ladder will afford safe means of exit for any such apartment. Where halls or stairs in an existing tenement house have been damaged by fire or otherwise to an extent greater than one-half the value thereof, such halls or stairs so damaged shall be repaired so as to conform to the requirements of this chapter with regard to halls and stairways relating to new tenement houses.

(b) All enclosed stairs in every tenement house shall have at least one handrail, and where the width of such stairs is greater than 3 feet 6 inches, such stairs shall have a handrail on each side thereof. All open stairs shall be provided with suitable and substantial handrails on each side.

(See Illustration Sec. 613).

665. Stairs in Non-Fireproof Buildings, Eighty or More Rooms.) Every new non-fireproof tenement house containing over eighty rooms, exclusive of bath rooms, shall have one additional flight of stairs, over and above the flights hereinbefore provided for, for every additional eighty rooms, or fraction thereof; but if such building contains not more than one hundred and twenty rooms, exclusive of bath rooms, at the owner's option, in lieu of an additional stairway, the stairs and public halls throughout the entire building shall be at least one-half wider than is provided in this chapter.

666. Stairs in Fireproof Buildings, One Hundred and Twenty Rooms and Upward.) Every new fireproof tenement house containing over one hundred and twenty rooms, exclusive of bath rooms, shall have one additional flight of stairs, over and above the flights hereinbefore provided for, for every additional one hundred and twenty rooms or fraction thereof; but if such building contains not more than one hundred and eighty rooms, exclusive of bath rooms, at the owner's option, in lieu of an additional stairway, the stairs and public halls throughout the entire building may be made at least one-half wider than is provided in this chapter.

667. Stairs—Entrance to—Treads and Risers.) Every flight of stairs required in a tenement house shall have an entrance on the entrance floor from a street or alley, or from a yard or court which opens into a street or alley. All stairs except rear stairs, in new tenement houses, shall have risers not more than seven and three-quarters inches high and treads not less than nine and one-half inches wide exclusive of nosings, except in winding stairs, where all treads at a point eighteen inches from the strings on the well side shall be at least nine and one-half inches wide, exclusive of nosings.

(See Illustration Sec. 613).

668. Fire Escapes.) Every tenement house four or more stories in height shall be provided with a fire escape or fire escapes, such as are required by this chapter. In every case each separate apartment shall have direct access to at least one such fire escape unless such apartment shall have direct access, without passing through any other apartment, to at least two separate flights of stairs leading to the ground, one of which is placed in front and one in the

rear of such building, and one of which may be placed outside of the building; but where such separate apartment shall not have access to two such flights of stairs, then such apartment shall have direct access to a stairway fire escape. Every court in which there is a fire escape shall have direct and unobstructed access along the surface of the ground to a street or alley or to yard opening into an alley or street without entering into or passing through or over any building unless by a four foot wide fireproof passage on the court or ground level. Except as herein specifically provided, the number, location, material and construction of fire escapes shall be controlled by the general provisions of this chapter on fire escapes.

669. Shafts, Courts, Yards, Graded—Drained.) In every now existing and new tenement house, the bottom of all shafts, courts or yards shall be provided with sanitary drainage and shall be graded or paved.

670. Access to Rooms—Otherwise than Through Bedroom.) In each apartment in every new tenement house, access to every living room and bedroom, and to at least one water closet compartment shall be had without passing through any bedroom.

671. Water Closets—Window in—Artificial Light.) (a) In every new tenement house there shall be a separate water closet in a separate compartment within each apartment, except that where there are apartments consisting of only one or two rooms, in which case there shall be at least one water closet for every two apartments.

(b) Every water closet compartment in every existing tenement house shall be ventilated by such a window, or else by a vent shaft of at least one-half the minimum area required in Section 645. Every water closet compartment in every tenement house shall be provided with proper means of artificially lighting the same. If fixtures for gas or electricity are not provided in any such compartment, then the door thereof shall have ground glass panels or transoms.

672. Sinks—Requirements.) In every new tenement house there shall be in each apartment at least one kitchen sink with running water. In every existing tenement if there be not one such sink in each apartment there shall be on every floor at least one kitchen sink with running water, accessible to all the tenants of the floor, without passing through any other apartment. In no tenement house shall there be woodwork inclosing sinks; the space underneath sinks shall be left entirely open.

673. Pipes Through Floors—Catch Basins—Water Closets.) (a) In every new tenement house where plumbing or other pipes pass through floors or partitions, the openings around such pipes shall be sealed tight with plaster or other incombustible material, so as to prevent the passage of air or the spread of fire from one floor to another or from room to room.

(b) In the premises of a tenement house the catchbasin shall, whenever practicable, be placed in a court or yard, and shall be covered with a stone or iron cover, flush with the surface so that access to such basin shall be convenient.

(c) Where it is for any reason impracticable to place a catchbasin in a court or yard, the Commissioner of Health may authorize the use of an iron catchbasin with air-tight cover, located in the cellar or basement.

674. Buildings Damaged by Fire, Etc.) If any existing tenement house is hereafter damaged by fire or other cause, including ordinary wear, so that at any time its value be less than one-half its original value ex-

clusive of the value of the foundations, such building shall not be repaired or rebuilt except in conformity with the provisions of this ordinance applicable to new tenement houses.

675. Provisions of this Article Not to Apply to Existing Buildings, Except Under Certain Circumstances—Then Commissioner to Notify.) (a) Nothing in this Article contained shall be construed as requiring alterations in the construction or equipment of buildings in existence at the time of the passage of this Article and which at the time of their construction were built in compliance with the ordinances then in force, unless they are in conflict with the requirements of Section 649, 668, 669, 672, 677, 678, and 679 or unless such buildings shall not have sufficient or adequate means of egress therefrom, by reason of insufficient or inadequate stairways, improperly located or insufficient or inadequate elevators or elevator equipment, doors, fire escapes, windows or other means of egress or ingress.

(b) Where it shall appear to the Commissioner of Buildings that any such building has insufficient means of egress therefrom as aforesaid, he shall notify the owner, agent or person in possession, charge or control of such building of such fact and direct him forthwith to make such alterations and changes in the construction or equipment of such building, as are necessary to be made in order to promote the safety of the occupants of such building and of persons using the same and of the public.

676. Rooms and Halls—Additional.) Every room or hall that may hereafter be constructed or created in an existing tenement house shall comply in all respects with the provisions of this ordinance as to size, arrangement, light and ventilation of rooms and halls.

677. Rooms—Change in Existing.) No room in any now existing tenement house shall hereafter be constructed, altered, converted or occupied for living purposes, unless it contains a window having a superficial area not less than one-twelfth of the floor area of the room, which window shall open upon a street or alley or upon a yard or court having a superficial area of not less than twenty-five square feet and a minimum width of not less than two feet six inches, or unless such room adjoins another room in the same apartment, which other room shall have such a window opening upon such a street, alley, yard or court, between which two adjoining rooms there shall be an alcove opening equal in extent to at least 20 per cent of the entire wall surface of said room, provided, however, that all of the requirements of Sections 641 and 642 shall be complied with.

Where a frame tenement house is moved from one lot to another, or from one location to another on the same lot, it shall comply with the provisions of Section 654 of this Chapter.

(See Illustration Sec. 470 B).

678. Windows—Courts—Attic.) No room in any now existing tenement house, which has no such window as aforesaid, opening upon a street or alley or upon a yard or court having a superficial area of not less than twenty-five square feet, shall hereafter be constructed, altered, converted or occupied for living purposes, unless it contains a floor area of at least sixty square feet and also at least six hundred cubic feet of air space; nor unless every part of the finished ceiling of such room be at least seven feet six inches distant from every part of the finished floor thereof; provided, that an attic room need be seven feet six inches high in but one-half of its area, and, provided, further, that such attic room has not less than seven hundred fifty cubic feet of

air space therein; and such attic room shall not be used for purposes of human habitation other than as a sleeping room.

(See Illustration Sec. 470 B).

679. Existing Tenements—Living Rooms in Cellars or Basements—When Permitted.)

(a) In every existing tenement house, no room in an existing cellar or basement shall be occupied for living purposes unless such room shall be at least seven feet six inches high in the clear, and have not more than four feet eight inches of such cellar or basement below the finished grade at building; provided that no such room shall be used for living purposes unless such room shall have a window opening upon a street, alley, yard or court, and, provided, that when the windows of any living room front solely upon a street and the floor of such basement is four feet eight inches below the sidewalk grade, such windows shall be located not less than three feet back of the lot line; provided, however, that in every case where the height of ceiling of any living room is less than eight feet six inches in the clear, the window area of such room shall be at least 15 per centum of the floor area.

(b) When a brick or frame tenement house is moved from one lot to another or from one location to another on the same lot and a basement or story, or both, is constructed under the same, the total height of which is more than six feet six inches from the floor to the ceiling, the walls of such basement shall be constructed of masonry according to the provisions of Section 872, and the habitable rooms therein shall comply with the provisions of Section 677, and the space on the lot shall comply with the provisions of Section 641 and Section 642.

680. Insanitary Conditions—Nuisance.) A tenement house or part thereof which is in an insanitary condition by reason of the basement or cellar being damp or wet, or by reason of the floor of such basement or cellar being covered with stagnant water or by reason of the presence of sewer gas, or by reason of any portion of such building being infected with disease, or being unfit for human habitation, or which by reason of any other insanitary condition is a source of producing sickness among the inhabitants of this city, or which in any way endangers the public health, is hereby declared to constitute a public nuisance.

ARTICLE X.

Class VII.

681. Class VII Defined.) In Class VII shall be included every building used for the sale at retail of dry goods and other articles of general merchandise and commonly known and described as a department store.

682. Must Comply With General and Special Provisions.) Every building of Class VII shall comply with the general provisions of this chapter, and, in addition to the general provisions, shall comply with the following special provisions:

683. Buildings of Class VII—Construction of.) Buildings three stories or less in height, used either wholly or in part for the purpose of Class VII, may be of ordinary construction. Such buildings more than three and not exceeding five stories in height shall be of slow-burning, mill or fireproof construction. Such buildings over five stories in height shall be of fireproof construction.

684. Stores Used for Retail Sale of Goods or Manufacturing Purposes—Occupation of Basement—Lockers.) (a) Not more than the lower twelve stories above the street grade shall be used for the retail sale of goods, or for locker provisions in excess of accommodations for the number of em-

ployes on the floor on which they are employed, or for manufacturing purposes in a building devoted wholly or in part to purposes of Class VII except as hereinafter provided; provided, however, the stories above the twelfth story may be used for these or other purposes when equipped with an approved automatic sprinkler system approved by the Chief Fire Prevention Engineer; and provided further, that all such buildings hereafter erected to be used for these purposes, or so used, above the twelfth story shall in addition to being equipped with an approved automatic sprinkling system have enclosed stairways.

(b) Not more than one floor of any basement or cellar shall be used for the retail sale of goods. Such floor shall be the floor nearest to the inside street grade. Such floor used for the retail sale of goods shall not be more than twenty feet below the inside street grade: Provided, however, that in all existing buildings of fireproof construction having a floor not more than thirty-two feet below the inside street grade, and having a partial intermediate floor or gallery between such floor and the level of the inside street grade, with an opening through such intermediate floor not less than forty feet by forty feet in area, and having direct exits on such floor and intermediate floor or gallery connecting on substantially the same levels with the floors of adjacent buildings of fireproof construction, the retail sale of goods shall be permitted on such floors not more than thirty-two feet below the inside street grade if such floors shall be properly and thoroughly ventilated and mechanically supplied with not less than two thousand cubic feet of air per hour for each twenty square feet of floor area, exclusive of walls, stairs and elevators, and if such buildings are equipped throughout and on such floors below the inside street grade with an automatic sprinkler system approved by the Chief Fire Prevention Engineer; and if the number and character of stairways and emergency exits comply with the provisions of this chapter applicable to buildings of Class VII of fireproof construction; and further provided, that in addition to the foregoing requirements there shall be at least one fireproof stairway enclosed in a fireproof tower extending from such sub-basement to the first floor of such building with no openings into said tower except from the sub-basement and first floor.

(c) Except as above provided in paragraph (b) of this section in relation to existing buildings, no sub-basement, cellar or part of a basement below such floor shall be used for the sale of any goods in any manner, but locker and dressing rooms may be placed in the sub-basement, provided the space thus occupied be separated from the remainder of the basement by fireproof partitions, and that there be at least two flights of stairs placed as far apart as practicable leading therefrom to the first floor, inclosed in fireproof partitions. Such stairs from such locker or dressing rooms shall be, in addition to other stairways required by this chapter for such buildings, and at least one of such stairways shall open directly on a street, alley or court opening on a street or alley, or on a fireproof passage leading to the street, alley or such court. Where more than five lockers are in one room, such lockers shall be of incombustible material.

(d) Where stories above the twelfth story are used for the purposes of Class VII as hereinbefore described for locker provisions in excess of accommodations for employes on the floor on which they are employed, then the stairways from the first to the topmost floor shall be built and inclosed as described in Section 880, but the stairways shall be in number and aggregate width as required in the table for stairways set forth in Section 878 of this chapter.

685. Floor Areas—Maximum.) (a) The

floor area, except as hereinafter provided, of any one story or portion of a story used for the purposes of Class VII of any building of ordinary construction shall not exceed nine thousand square feet.

(b) The floor area, except as hereinafter provided, of any one story or portion of a story used for the purposes of Class VII of any building of slow-burning or mill construction shall not exceed twelve thousand square feet.

(c) The floor area, except as hereinafter provided, of any one story or portion of a story used for the purposes of Class VII of any building of fireproof construction shall not exceed 25,000 square feet, unless the building is completely equipped with an approved automatic sprinkler system, but in no case shall such area exceed 30,000 square feet.

686. Floor Areas—Exceeding the Maximum Limits Defined in Section 685.) (a) Where any floor or portion of a floor used for the purposes of Class VII in any building shall exceed in area the maximum number of square feet allowed in the preceding section for the type of construction of such building in which such floor is contained, each such maximum amount of floor area so used shall be separated from other parts of such floor by fire walls, or dividing walls built in accordance with the provisions of Section 463 of this chapter relating to dividing walls in buildings of Class I.

(b) Where any such floor so used is divided by such fire walls or dividing walls, each such division of such floor shall be provided with stairs, aisles, exits, and fire escapes as required in this chapter for separate and distinct buildings, and each such division shall be considered as a separate building, except as provided in Section 712 of this chapter.

687. Galleries.) (a) The area of any or all of the galleries, mezzanine or intermediate floors in any one story used wholly or in part for the purposes of Class VII in any building shall not exceed ten per centum of the area of such story. Galleries, mezzanine or intermediate floors of a larger size than the above shall be considered as full stories.

(b) Every gallery, mezzanine or intermediate floor shall have at least one stairway not less than three feet wide.

(c) The height from the floor of any gallery, mezzanine or intermediate floor to the ceiling over same shall not be less than

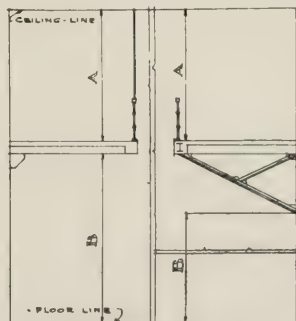


Fig. 16.

SECTION 687 C.

A—height from floor of any gallery, mezzanine or intermediate floor to ceiling over same.

B—space between the bottom of such gallery, mezzanine or intermediate floor and the floor of the story in which such gallery, etc., is placed.

Explanation:

A—shall not be less than 7'0".
B—shall not be less than 7'0".

seven feet, and there shall be not less than seven feet of space between the bottom of such gallery, mezzanine or intermediate floor and the floor of the story in which such gallery, mezzanine or intermediate floor is placed.

(d) Every gallery, mezzanine or intermediate floor in any building used for the purposes of Class VII shall be built to conform to the construction applicable to such building, but galleries not exceeding five per centum of the area of such story, may be built of incombustible material without fireproof protection.

(e) No gallery, mezzanine or intermediate floor shall be built without a permit from the Department of Buildings, and plans showing the construction and size of such proposed gallery, mezzanine or intermediate floor shall be filed with the Department of Buildings when a permit is applied for.

683. Courts of Class VII Buildings.) (a) Every court or light shaft of every building used wholly or in part for the purposes of Class VII shall be open and unobstructed from the bottom of such court to the sky, with the exception that fire escapes may be built therein, and such courts shall have walls constructed in the same manner as is required for the exterior walls of such buildings; provided, that no walls inclosing such courts are required on street or alley lot lines.

(b) All windows, doors or other openings in court walls of such buildings shall have metal frames, metal sashes and metal doors, with the glazed portions thereon of wired glass.

689. Stories—Numbering of.) The first story above the inside street grade shall be designated and known as the first story for all purposes of this chapter, and the stories above shall be numbered consecutively, the second, third, and so on.

690. Stairs — Halls — Passageways and Aisles—Signs and Lights.) (a) The stair halls, passageways and stair aisles shall be unobstructed and be as wide as the stair and not less than four feet wide in the clear.

(b) The exit door or doors between floors and stair halls shall be not less than ninety per centum of the width of the stairway to which they afford access, and for each elevator opening into such a stair hall, the doors to floors shall be increased six inches in width.

(c) The stairways and stair halls of any building used wholly or in part for the purpose of Class VII shall be illuminated by gas or electric light, and the gas piping and the electric wiring shall be accomplished by piping and circuits separated and distinct from the general illuminating piping and circuits of the premises. Each stair light shall have a red glass inclosure.

(d) At the bottom of each such stairway there shall be an illuminated red glass sign with the number of the story in which it is situated inscribed thereon in letters not less than six inches high.

691. Exit Signs and Lights.) (a) All exits in buildings used wholly or in part for the purposes of Class VII shall be clearly indicated by illuminated red signs with the word "Exit" thereon in letters not less than six inches high. At the bottom of each stairway on the street floor level there shall be similar signs indicating the direction of the nearest exit to a street or alley.

(b) Fire escape doors or windows shall be indicated by illuminated red signs with the words "Fire Escape" thereon in letters not less than six inches high.

692. Doors at Street Level—Revolving Doors.) The clear width of the exit openings shall be computed in the same manner as that provided in this article for main aisles,

and no door openings shall be less than five feet wide, and all doors shall swing outward. Revolving doors shall not be considered as complying with this section unless the revolving wings of such revolving doors are so arranged that by the application of a force slightly more than is necessary to revolve said doors and which one person of ordinary strength is capable of exerting, all the wings of said doors fold flat on each other and in an outward direction, or unless the revolving wings of said revolving doors are so arranged that they may be readily collapsed or removed by pressure or simple mechanical means, to be approved by the Commissioner of Buildings, and leave sufficient opening for two or more persons to pass through with a minimum width of not less than twenty-two inches on each side of said collapsed doors.

Where revolving doors are used as exits they shall be credited as exits only to the extent of the clear space remaining when the doors are collapsed, and all deficiency of required exits must be made up by additional doors.

693. Doors in Dividing Walls.) (a) Door openings may be built in dividing walls of such buildings; provided, however, that such door openings shall be not less than five feet in width and shall be provided with fireproof doors built as described in Section 789 of this chapter, and that each door shall have an efficient closing device which will operate automatically in the event of a fire in close proximity to either side of such door.

(b) Each such opening shall have exit signs and lights as provided for street doors and exits in Section 691 of this chapter.

694. Loads—Allowance for Live Loads in Construction of Floors of Buildings of Class VII.) For all buildings of Class VII the floor shall be designed and constructed in such a manner as to be capable of supporting, in addition to the weight of the floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floors, and shall be figured in accordance with Section 729 of this chapter.

ARTICLE XI.

Class VIII.

695. Class VIII Defined—Provisions of.) In Class VIII shall be included every building used for school purposes and every building containing class rooms for special or general instruction, other than halls for the purpose of instruction as included in Class IV, where such building so used shall have a seating capacity of more than fifty students.

696. Must Comply With General and Special Provisions.) All buildings of Class VIII shall comply with the general provisions of this chapter wherever the same are applicable thereto, and in addition to such general provisions shall comply with the following special provisions:

697. Construction of.) (a) All buildings hereafter erected and used or intended to be used wholly for the purposes of Class VIII shall be constructed in accordance with the provisions of this chapter relating to Class VIII; and existing school buildings shall comply with the provisions of Class VIII with reference to stairs, exits and fire escapes.

(b) Buildings which have a seating capacity of two hundred or less and which are not over two stories and basement in height, may be built of ordinary construction; provided, that no portion of such building shall be used for assembly hall purposes.

(c) Buildings which have a greater seating capacity than two hundred and not ex-

ceeding four hundred, and which are not over three stories and basement in height, shall be built of slow-burning or fireproof construction.

(d) Buildings which have a greater seating capacity than four hundred, or which are more than three stories and basement in height, shall be built entirely of fireproof construction.

(e) Additions to existing buildings shall be built of the several types of construction required by this section; provided, however, that the sum total of the seating capacity of the entire building, including additions, shall be counted in determining the type of construction required for such addition.

(f) All alterations in existing buildings used for the purposes of Class VIII, other than new additions thereto, and intended to make them comply with the requirements of this chapter, may be executed in the same kinds of materials originally used in such buildings, unless otherwise distinctly provided herein.

698. **Walls—Window Openings in.)** No wall of any building used for the purposes of Class VIII and containing a window opening shall be nearer than five feet to any lot line of adjoining property, street and alley lines not included.

699. **Portable Frame Buildings.)** Portable frame buildings used wholly for the purposes of Class VIII, not larger than 28 by 36 feet and not over one story high, may be erected, provided exterior walls and roof of same are covered with metal or other incombustible material, and the interior woodwork painted with fire-retarding paint approved by the Commissioner of Buildings; and, provided, further, that the location of such buildings shall be approved by the Commissioner of Buildings. Such portable buildings shall not be located nearer than ten feet to any other building, and shall not be maintained on any one lot or block for a longer period than two years after the date of the issuance of the original permit.

700. **Assembly Halls—Limitations as to Seating Capacity and Floor Level.)** (a) The limit of height at floor level and the maximum seating capacity of assembly halls or auditoriums or other single rooms in buildings of this Class must not exceed the numbers given in the following table, for the specified type of construction, to-wit:

Floor— Height of Above Grade.	Type of Construction—		
	Slow burning or Mill Construction Having Fireproof	Stairs and Corridors.	Ordinary Construction.
	Fireproof Construction.	Persons.	Persons.
Over 60 ft.....	500	100	...
60 ft. or less..	600	300	...
45 ft. or less..	700	500	...
30 ft. or less..	1000	800	250
20 ft. or less..	1500	900	500
10 ft. or less..	2000	1000	800
5 ft. or less..	2500	1200	1000

(b) All assembly halls or other single rooms having a seating capacity larger than that given in the above table must have the highest part of the main floor within not more than one foot of grade level and must have exits leading directly to three streets, public alleys, or to open public grounds.

(c) Seating capacity of all assembly halls in buildings of this Class shall include the total aggregate seating capacity of all balconies, galleries, stages and platforms as well as the main portion of such assembly hall or rooms.

(d) Heights of assembly hall floors shall be measured from sidewalk level at entrance of building or open school grounds to highest part of main floor of such assembly hall or rooms.

701. **Stairways—Width of—Handrails.)** (a) Stairways in buildings used for the purposes of Class VIII shall be equivalent in width to fifteen inches for every hundred of seating capacity in such building as measured by the aggregate seating capacity of the auditorium, assembly rooms and school rooms; provided, however, that the number of persons allowed in such buildings at any one time shall be limited by the width of stairways available as exits therefrom.

(b) No stairway shall be less than four feet in the clear, except where more than two stairways lead down from any floor, in which case stairways three feet in width in the clear may be counted in the total width of stairs required.

(c) Where two or more stairways are used, they shall be placed at opposite ends of the building or as far apart as practicable, and all such buildings hereafter erected shall have at least two separate and distinct stairways from the ground floor to the top floor, and all existing buildings shall have two such separate and distinct stairways, or one stairway and one sliding or stairway fire escape.

(d) All stairways in buildings of Class VIII shall have hand railings on each side thereof. No stairway shall ascend a greater height than thirteen feet six inches without a level landing, the dimensions of which, in the direction of the run of the stairs, shall not be less than four feet, or which, if at a turn of the stairs, shall be of not less width than the width of the stairs. No winder shall be permitted in any stairs. Stairways which are over nine feet wide shall have double intermediate hand rails with end newel posts at least five and one-half feet high at each stair landing. All stairways shall discharge at the bottom directly to a public thoroughfare or open ground.

(See Illustration Sec. 613).

702. **Stairways in Buildings Hereafter Erected—Fireproof.)** In buildings hereafter erected more than two stories and basement in height, the stairways and their enclosing walls shall be of fireproof construction.

703. **Width of Corridors, Passageways, Hallways and Doorways.)** The width of corridors, passageways, hallways and doorways shall be equivalent in width to eighteen inches for every one hundred of seating capacity of such portions of building as will be required to use same for exit. No corridor, passageway or hallway shall be less than five feet in width, and no doorway less than three feet in width, except where two or more doors, each two feet eight inches or more in width, are grouped together.

704. **Doors to Open Outward—Covering of.)** All doors in such buildings shall open outward. All exit doors from assembly halls to other parts of the building shall be covered with metal or other fireproof material approved by the Commissioner of Buildings.

705. **Aisles—Width of—In Assembly Halls and in Recitation and Study Rooms.)** (a) Aisles in assembly halls in buildings of Class VIII shall be equivalent in width to eighteen inches for every one hundred seating capacity in such assembly hall, but no such aisles shall be less than two feet six inches in its narrowest part. All groups of seats shall be so arranged that they shall have an aisle on each side, and not more than twelve seats in any one row shall be placed between aisles.

(b) Aisles in class rooms, recitation rooms and study rooms of such buildings shall be equivalent in width to eighteen inches for every one hundred permanent seats in any such room, but no aisle shall be less than sixteen inches in width and no main or cross aisle be less than two feet six inches in width.

706. Emergency Exits for Assembly Rooms—Aggregate Width of.) All assembly halls of such buildings having a seating capacity of eight hundred or more shall be provided with at least two emergency exits. The aggregate width of such emergency exits, which shall be provided for each floor, balcony or gallery of such assembly hall, shall be not less than nine inches in width for every one hundred of seating capacity or portion thereof. No emergency exit or stairway shall be less than three feet in width. Emergency exits must be located as far apart and as far from main exits as practicable, subject to the approval of the Commissioner of Buildings.

707. Lights in Buildings—Window—Skylights.) (a) Provisions shall be made to properly light every portion of any such building devoted to the uses or accommodations of the public and all outlets therefrom leading to the street, including the open courts and corridors, stairways and exits, during the entire time such building is in use.

(b) All gas or electric lights in the class rooms of main building and in halls, corridors, lobbies, stairs and exits leading from the assembly halls shall be independent of lights in assembly hall. By "independent" shall be construed a separate pipe from meter or separate circuits from switch-board.

(c) The total glass area of outside windows and skylights of each class room, recitation room or study room in such buildings shall be not less than one-fifth of the floor area of such room.

(d) Class rooms, recitation rooms and study rooms that have exterior windows on one side only must have the top of glass in such windows at a height above the floor of such room of not less than one-half of the distance to the opposite parallel wall or partition.

(e) Such rooms having exterior windows on two opposite sides of the room shall have the top of glass in such windows not less than one-fourth the distance between walls in which the windows are placed. The height of windows in corner rooms having windows in adjacent walls shall be computed from nearest wall or partition to opposite window.

(f) Where skylights or skylights and windows of sufficient size to give the proper glass area are used these heights of windows shall not be required.

708. Scenery—Sliding Curtains—Screens.) No curtains or scenery shall be used in any assembly hall, except only, that it shall be permissible to use a pair of sliding curtains hung on horizontal metal rods not over twelve feet above the floor of stage and portable screens set on the floor and not over eight feet high. Provided, however, in assembly halls located on the first floor or ground floor of a fireproof building, it shall be permissible to use curtains hung from the ceiling or top of proscenium opening.

709. Moving Picture Machines.) Moving picture machines may be installed and used in assembly halls located on the first floor or ground floor of fireproof buildings of Class VIII. When moving picture machines are so used they shall be located in booths constructed of fireproof materials with metal clad doors and a vent duct to the outside air having a cross sectional area of at least 100 square inches.

710. Basement When Used for Class Rooms.) (a) In every such building in which the lower or basement floor is below the surface of the ground surrounding such building, and is used in part or as a whole for heating or ventilating apparatus, such

floor shall be considered the basement story of such building.

(b) Class rooms, recitation rooms or study rooms shall not be allowed in basements less than twelve feet in height in the clear nor where the floor is more than two feet below the level of the sidewalk at nearest entrance of building nor in basements which are not properly lighted by windows or skylights as defined elsewhere in this Chapter for such rooms.

711. Stories—Height of.) No story above the basement shall be less than twelve feet in height in the clear.

712. Fire Escapes.) (a) Every building used for the purposes of Class VIII of four or more stories in height, shall be provided and equipped with stairway fire escapes or sliding fire escapes as herein provided:

(b) All such buildings having a seating capacity of less than two hundred on any one floor above the third floor shall have at least one such fire escape.

(c) All such buildings having a seating capacity of over two hundred but less than four hundred in any one story above the third floor shall have at least two such fire escapes.

(d) All such buildings having a seating capacity of more than four hundred but less than six hundred on any floor above the third floor shall have at least three such fire escapes.

(e) At least one additional stairway or sliding fire escape shall be provided for every increase of two hundred seating capacity in any one story above the third floor.

(f) Stairway fire escapes shall be built in accordance with the requirements of Sections 881, 882 and 885, and shall be subject to the approval of the Commissioner of Buildings.

(g) Sliding fire escapes shall be securely anchored or fastened to the building and shall have a radius or width of not less than thirty-six inches, and the inner side of the same shall be entirely smooth and made of metal. There shall be an entrance to each sliding fire escape from each floor above the first story. They shall be of a pitch of not less than thirty degrees nor more than forty-five degrees for straight runs. They shall be so constructed that they will discharge people not more than twenty-four inches from the adjacent ground or floor. They shall be of such pattern and design as will best secure the safety of the public, and their construction, location and maintenance shall be subject to the approval of the Commissioner of Buildings. Spiral sliding fire escapes shall have two complete turns for each story height of more than thirteen or less than sixteen feet.

(h) All the provisions of this Chapter relating to outside sliding or stair fire escapes shall apply to buildings of Class VIII, unless such buildings are fireproof, in which case interior fire escapes from ground to roof may be substituted for exterior fire escapes, provided such interior fire escapes shall comply with each and all of the following conditions:

(i) Interior fire escapes in fireproof buildings shall be enclosed in brick or concrete walls on all sides from top to bottom, and shall be enclosed at the top with a fireproof penthouse. The treads and risers of such interior fire escapes shall be the same as those used for stairs elsewhere in the building and the width of such fire escapes shall not be less than forty inches in their narrowest part between hand rails.

(j) The landings of such fire escapes shall, exclusive of and in addition to the space covered or occupied by swinging doors, be at least equal to the stairs in width. All doors leading to such fire escapes shall be incombustible doors and

the glass portion thereof shall be glazed with polished wired glass not less than one-quarter of an inch thick, which shall be large enough to enable persons to see other persons on the opposite side of the door. The combined width of said doors on each landing shall exceed the stair width twenty-five per cent, but no single door shall be more than three feet wide. They shall be hinged and equipped with automatic opening and closing devices and shall open outward. Windows lighting such fire escapes shall have metal frames and sash and wired glass.

(k) The number and capacity of such interior fire escapes shall in no case be less than is elsewhere in this Chapter required for outside fire escapes, and the locations of the same shall be as far apart as practicable and so placed as to best secure the safety of the persons using the same in case of fire, accident or panic.

(l) Such interior fire escapes which comply with all the conditions above enumerated may be used daily as ordinary stairs.

713. The Commissioner of Buildings, the Chief Fire Prevention Engineer, Commissioner of Gas and Electricity, and Superintendent of Police shall close Buildings for Violations.) The Commissioner of Buildings, the Chief Fire Prevention Engineer, Commissioner of Gas and Electricity, and Superintendent of police, or any of them, shall have the power to close or order closed any building used wholly or in part for the purposes of Class VIII wherein there is any violation of any ordinance which it is their duty to enforce, and to keep the same closed until such provisions are complied with.

ARTICLE XII

Class IX.

714. Class IX Defined.) In Class IX shall be included every building maintained by the City of Chicago for police station purposes.

715. Requirements General.) Every building of Class IX shall comply with the general provisions of this chapter wherever the same are applicable thereto, and in addition to the general provisions shall comply with the following special provisions:

716. Construction.) (a) All buildings of Class IX not more than two stories and basement in height may be of ordinary mill, slow-burning or fireproof construction.

(b) All buildings of Class IX more than three stories and basement high shall be built of fireproof construction.

All buildings of Class IX containing a court room or court rooms above the second story shall be built of fireproof construction.

All buildings of Class IX three stories and basement or less in height which do not contain a court room or court rooms above the second story may be built of ordinary construction excepting that part of the building containing the cell room or lockup and the patrol wagon quarters, or either of them, which part shall be built of fireproof construction and shall be separated from all other parts of the same building by a wall of the same character and thickness as is required by this chapter for the outside walls of such building and where necessary by a fireproof floor and ceiling of the same thickness as the brick walls by which said floor and ceiling is supported.

(c) Buildings erected for or converted to the use of police stations for temporary purposes may be of mill or slow-burning construction not more than ninety feet in height from the average inside sidewalk grade of the street in front of the building to the highest part of the roof of the building.

717. Allowance for Live Loads and Construction of Floors of Class IX.) The floors of all buildings of Class IX shall be designed and constructed as follows:

In all buildings of Class IX the floors of all court rooms, and of all public corridors, and of all stairways leading to same, shall be designed and constructed in such a manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface, and all other floors, or parts thereof, shall be designated and constructed so as to be capable of carrying a live load of fifty pounds for every square foot of floor surface, and such floor-bearing capacity shall be computed in accordance with this chapter.

718. Windows.) (a) In every building of Class IX every room, including court rooms, public and private offices, shall have at least one window opening directly upon a street, alley, yard or court; the total glass area of such window or windows shall not be less than one-tenth of the floor area of such room. The top of such windows shall be at least seven feet above the floor and at least the upper half of such windows shall be capable of being opened. Such window shall have a glass area of at least ten square feet unless it be a window in excess of one-tenth of the floor area as required by this paragraph. Cell blocks shall have at least three outside walls of same to face upon a street, alley, yard or court and where windows are placed in the three sides with a total glass area equal to one-fourth of the floor area of such block and each window is arranged so that it may be opened for one-half of its area, it shall not be required that each cell open onto a street, alley, yard or court. No sleeping rooms or cell rooms shall be allowed below the first floor level in any building of Class IX.

(b) In every building of Class IX every pantry, bath room, water closet and urinal compartment shall have at least one window which opens directly upon a street, alley, yard, court or vent shaft; the total glass area of such windows shall be not less than one-tenth of the floor area of such room or compartment. The top of such windows shall be at least seven feet above the floor and at least the upper half of such windows shall be capable of being opened; and no such windows shall have a glass area of less than six square feet or a glass width of less than one foot; provided, however, that such room or compartment, if located on the upper story of such building, may be lighted and ventilated by means of a skylight having a glass area of at least one-tenth the floor area of the room it serves and is equipped with an efficient ventilator or ventilators equal in effective area to one-twentieth the floor area of such room.

719. Courts and Shafts.) In every building of Class IX courts shall be of the minimum width and area as prescribed in Section 644 of this chapter and vent shafts shall be of the minimum width and area as prescribed in Section 645 of this chapter.

720. Height of Rooms.) In every building of Class IX the height of all rooms except basement rooms shall be not less than ten feet from the level of the floor to the ceiling thereof, and the height of court rooms, if any, shall not be less than eleven feet from the level of the floor to the ceiling thereof.

721. Thickness of Walls.) The walls of every building of Class IX shall comply in thickness with the requirements of Section 732 of this chapter as therein prescribed for buildings of Class I.

722. Stairways and Fire Escapes.) Every building of Class IX shall be equipped with

stairways and fire escapes in number and dimensions as follows:

In buildings of ordinary, slow-burning or mill construction which do not contain a court room or court rooms and with a floor area of 5,000 square feet or less, two stairways.

With floor area of 5,000 to 9,000 square feet, three stairways.

In buildings of ordinary, slow-burning or mill construction which contain court rooms and with a floor area of less than 5,000 square feet, two stairways and one stairway fire escape.

With floor area of 5,000 to 9,000 square feet, three stairways and one stairway fire escape.

In buildings of fireproof construction with a floor area of 7,000 square feet or less, two stairways.

With floor area of 7,000 to 15,000 square feet, three stairways.

With floor area of 15,000 to 21,000 square feet, four stairways.

All buildings of Class IX over four stories in height must be equipped with stairway fire escapes as follows:

With a floor area of 7,000 square feet or less, one stairway fire escape, three feet in width.

With a floor area of 7,000 to 21,000 square feet, two stairway fire escapes not less than three feet in width.

No stairways in buildings of Class IX shall be less than four feet in width between hand rails.

In buildings less than three stories high and in buildings three stories high which may be built of ordinary construction by the provisions of this article, stairways may be of ordinary construction enclosed in brick walls of thickness as required by paragraph (h), Sec. 732 of this chapter, or stairways may be of fireproof or incombustible material enclosed in partitions of fireproof or incombustible material.

723. Exits from Court Rooms—Handrails on Stairways.) (a) There shall be two direct exits located as far apart as practicable from every court room in a building of this class; the width of such exits shall be computed on a basis of twenty inches for each 100 persons of the aggregate capacity of such court room, and for fractional parts of 100 capacity, a proportionate part of twenty inches shall be added to the width of such exits, but no such exits shall be less than three feet wide in the clear. One of such exits shall open onto a public corridor not less than six feet wide from which there is a stairway leading to the ground at least four feet wide in the clear between hand rails. Where there is but one stairway from such public corridor an additional exit from each court room must be afforded by a stairway at least four feet wide in the clear between hand rails or by means of an outside iron stairway not less than three feet wide; the platform of which shall be placed approximately level with the floor of the court room and accessible by a door not less than three feet in width.

724. Doors to Open Outward.) In buildings of Class IX all doors which afford ingress or egress from all rooms, except private offices, shall open outward.

ARTICLE XIII.

General Provisions.

725. Construction or Alteration of Building—Requirements.) Every building or structure or part thereof, hereafter constructed, erected, altered, enlarged, repaired or changed within the City shall be so constructed, erected, altered, enlarged, repaired or changed, in accordance with the provisions of this Chapter.

726. Class of Buildings Not to Be changed Without Conforming to Provisions of This

Chapter.) If buildings, the uses of which bring them within any of the classes mentioned in this Chapter, are to be applied to the uses of any other class for which a better system of construction is required by this Chapter, the construction and equipment of such buildings shall first be made to conform to the requirements of this Chapter as specified for their intended use. And it shall be unlawful to use any such building for a new or different purpose from that to which its structure and equipment adapts it under this Chapter, unless a permit for such alterations or use shall have been first obtained from the Commissioner of Buildings and the requirements of this chapter for such new or different use shall have been complied with.

727. Alterations of Existing Buildings.) (a) In construing the several sections of this Chapter, said sections shall not be construed as requiring alterations in the construction or equipment of buildings or structures in existence at the time of the passage of this Chapter, except where specifically provided, unless such buildings shall not have sufficient or adequate means of egress therefrom or ingress thereto, by reason of insufficient or inadequate stairways or stairways improperly located or insufficient or inadequate elevators or elevator equipment, doors, fire escapes, windows or other means of egress or ingress and except also as required in sections which are herein made retroactive.

(b) Whenever an Inspector of Buildings shall make a report to the Commissioner of Buildings that any such building has inadequate or insufficient means of egress therefrom or ingress thereto, as aforesaid, the Commissioner of Buildings shall notify the owner, agent, or person in possession, charge or control of such building of such fact and direct him forthwith to make such alterations and changes in the construction or equipment of such building as are necessary to be made in order to make such building comply with the requirements of this Chapter.

(c) If, however, it is desired to enlarge, or in any manner materially modify the construction of any existing building, or to make a change in its use or occupation which will transfer it from one class as recognized by this Chapter to another class, then, before such enlargement or structural change or modification of building is made, or before such change in its use or occupation may be made, written notice shall be given to the Commissioner of Buildings of the intention to change the character of the use, and the entire building shall be reconstructed or modified in such manner as to bring the same, when enlarged or altered, or when occupied for its new and different purposes, into compliance with the provisions of this Chapter.

728. Removal of Brick, Stone, Frame or Concrete Buildings.) It shall be unlawful for any person, firm or corporation to move any brick, stone, frame or concrete building from one location to another, unless the same shall be altered or re-constructed so as to conform to the ordinances governing the construction of such building at the time of moving the same and in its new location; provided, however, that whenever a tenement house is moved, the same shall be made to comply with the requirements of Section 677 and Section 679.

729. Live and Dead Loads—Wind Resistance.) (a) The "dead load" shall include all permanent portions of the building, also partitions and permanent fixtures and mechanisms supported by the building. The "live load" shall include all movable loads or weights placed on floors or other parts of buildings.

(b) All buildings shall be designed to resist a horizontal wind pressure of 20 lbs. per square foot for every square foot of exposed surface. In no case shall the overturning moment due to wind pressure exceed seventy-five per cent of the moment of stability of the building due to the dead load only.

(c) The "live" loads to be provided per square foot of floor areas, except stairs, for the classes of buildings except portions of Classes VIII and IX as herein otherwise provided shall be not less than the following:

	Pounds.
Class I.....	100
Class II.....	50
Class III.....	40
Class IV.....	100
Class V.....	100
Class VI.....	40
Class VII.....	100
Class VIII.....	75
Class IX.....	100

(d) Provided, however, that in Class VIII the portions of the building exclusive of the floors in assembly halls, the corridors and the stairs, shall not be required to be constructed to support a live load in excess of 40 pounds per square foot.

(e) The roofs of all buildings shall be designed and constructed in such a manner that they will bear a load in addition to the weight of their structure and covering, of at least twenty-five pounds for each square foot of horizontal surface.

(f) The live loads to be provided for on stairways for buildings of all classes shall not be less than 100 pounds per square foot of treads and landings.

730. Structural Details—Strength Tests—How Made.) (a) All structural details and workmanship shall be in accordance with accepted engineering practice, and subject to the approval of the Commissioner of Buildings.

(b) Floors, joists and beams shall be designed for the full dead and live loads. Floor girders shall be designed for the full dead and not less than eighty-five per cent of the live load.

(c) In buildings of Classes III and VI, except frame buildings, where the distance between enclosing walls or intermediate walls is more than twenty-five feet in the clear, intermediate supports for the joists shall be either brick, or concrete, or iron, or steel columns, beams, trusses, or girders.

Amended February 20, 1911.

(d) If brick walls are used for this purpose, they may, in all cases where the thickness of walls is given, in Section 732, as 16

inches or more, be made four inches less in thickness than the dimensions stated.

(e) Tests shall be made by the owner, upon the demand of the Commissioner of Buildings, on all forms of floor construction involving spans over eight feet. Such tests shall be made to meet the approval of the Commissioner of Buildings, and must show that the construction will sustain a load equal to twice the sum of the live and dead loads, for which it was designed, without any indication of failure. The construction may be considered as part of the test load. Each test load shall remain in place at least twenty-four hours. On arch construction, this test load shall be placed on one-half of the arch, covering the area from the support to the crown of the arch.

731. Walls, Piers and Columns—Dead and Live Loads.) (a) The full live load on roofs of all buildings shall be taken on walls, piers, and columns.

(b) The walls, piers and columns of all buildings shall be designed to carry the full dead loads and not less than the proportion of the live loads given at bottom of page.

(c) The proportion of the live load on walls, piers, and columns on buildings more than seventeen stories in height shall be taken in same ratio given at bottom of this page.

(d) The entire dead load and the percentage of live load on basement columns, piers and walls shall be taken in determining the stress in foundations.

(e) In addition to the entire dead loads, not less than the following proportion of the percentage of live load on the basement columns, piers and walls shall be taken in determining the number of piles for pile foundations and the area of concrete caissons.

Classes I and VII..... 75 per cent.

Classes II, III and VI..... 50 per cent.

Classes IV, V and VIII..... 25 per cent.

In all foundations eccentric loading must be provided for.

732. Requirements for Enclosing Walls—Table of Thickness—Exceptions—Definition of the Length of Wall—Buttresses, Piers or Pilasters—Inserting Columns in Walls—Anchorage of Walls and Floors—Definition and Limits for Height of Stories—Curtain Walls—Interior Walls to Support Fire-proof Floor Construction.) (a) The walls of all buildings, excepting the enclosing walls of frame buildings, shall be of brick, stone or concrete. The walls shall be solid and of solid material and except as otherwise herein provided shall be of the thickness in inches indicated in the table on next page.

Floor.....	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
17.....	85	85															
16.....	80	85															
15.....	75	80	85														
14.....	70	75	80	85													
13.....	65	70	75	80	85												
12.....	60	65	70	75	80	85											
11.....	55	60	65	70	75	80	85										
10.....	50	55	60	65	70	75	80	85									
9.....	50	50	55	60	65	70	75	80	85								
8.....	50	50	50	55	60	65	70	75	80	85							
7.....	50	50	50	50	55	60	65	70	75	80	85						
6.....	50	50	50	50	50	55	60	65	70	75	80	85					
5.....	50	50	50	50	50	50	55	60	65	70	75	80	85				
4.....	50	50	50	50	50	50	50	55	60	65	70	75	80	85			
3.....	50	50	50	50	50	50	50	50	55	60	65	70	75	80	85		
2.....	50	50	50	50	50	50	50	50	50	55	60	65	70	75	80	85	
1.....	50	50	50	50	50	50	50	50	50	50	55	60	65	70	75	80	85

(b) In Class VIII buildings the thickness of surrounding walls and of all dividing walls carrying loads of floors and roof shall be as indicated in the following table:

	Base- ment. in.	Stories				
		1	2	3	4	5
One story	16	12				
Two stories	16	16	12			
Three stories	16	16	16	12		
Four stories	20	20	16	16	12	
Five stories	24	20	20	16	16	16

(c) In Class VIII buildings, walls around stairs, elevators and air shafts and joist supports shall comply with the requirements of Section 855 of this Chapter.

(d) The basement walls of two-story buildings and the first story walls of three-story buildings in Classes III and VI may be twelve inches in thickness. The first story walls of one-story buildings and the second story walls of two-story buildings in Classes III and VI may be eight inches in thickness, provided that where a pressed brick face is used no wall shall be less than twelve inches in thickness, and an eight-inch brick or solid concrete partition wall may be built in a building of any class, but in no case shall any eight-inch brick wall be more than fourteen feet in height.

(e) The basement walls of two-story buildings in Classes II, III and VI may be 12 inches in thickness.

(f) In buildings of skeleton fireproof construction, the thickness of walls shall be governed by Section 837 of this Chapter.

(g) Walls less than fifty feet in length and walls less than fifty feet between cross walls, may be built four inches less in thickness than the thickness given in the aforesaid table, but no such wall in such build-

ings shall be less than twelve inches in thickness, provided, however, that such walls in buildings of Classes III and VI may be sixty-five feet in length; and further provided, that eight-inch walls may be used in one-story brick buildings and in the second story of two-story brick buildings of said last mentioned classes where said eight-inch walls are not more than fourteen feet in height and are supported by a foundation or wall not less than twelve inches in thickness.

(h) A brick wall not more than twenty-five feet long and forming one side of a brick shaft for stair, elevator or other purposes, need not exceed sixteen inches in thickness, nor its upper fifty feet twelve inches in thickness, provided that in no case shall the load on such brick wall exceed the safe load for brickwork prescribed by this ordinance.

(i) The length of a wall shall be the distance in which the wall extends in a straight line and shall be measured between angles of the masonry or between exterior and cross walls.

(See illustration on this page.)

(j) Where masonry buttresses or piers or pilasters are employed on either or both sides of a wall, then said walls may be reduced in thickness by one-half of the projection or projections of the buttresses or piers or pilasters, but no wall shall be reduced to less than twelve inches in thickness. The reduction in thickness may be made throughout the height of the wall, except that no twelve-inch wall shall be higher than thirty feet and no sixteen-inch wall shall be higher than fifty feet. The stress in the brickwork in any part of such walls shall not exceed the stress per square inch allowed by this chapter on the kind of masonry employed. Buttresses or piers or pilasters shall be at least one-tenth as wide, measured on face of same, as the spacing between the buttresses or pilasters. Twelve-

	Base- ment.	Stories											
		1	2	3	4	5	6	7	8	9	10	11	12
One-story	12												
Two-story	16	12	12										
Three-story	16	16	12	12									
Four-story	20	20	16	16	12								
Five-story	24	20	20	16	16	16							
Six-story	24	20	20	20	16	16	16						
Seven-story	24	20	20	20	20	16	16	16					
Eight-story	24	24	24	20	20	20	16	16	16				
Nine-story	28	24	24	24	20	20	20	16	16	16			
Ten-story	28	28	28	24	24	24	20	20	20	16	16		
Eleven-story	28	28	28	24	24	24	20	20	20	16	16	16	
Twelve-story	32	28	28	28	24	24	24	20	20	20	16	16	16

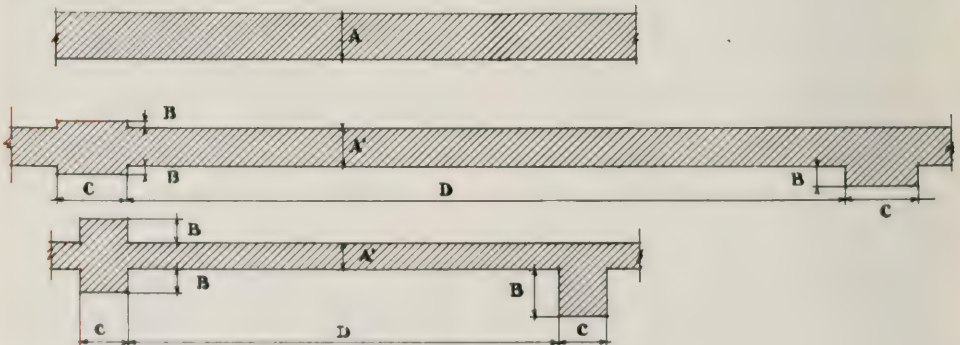


Fig. 17.

THICKNESS OF WALLS. Section 732j.

A = thickness of wall.
A' = thickness of wall after reduction.
B = projection of buttresses, piers or pilasters.
C = width of buttresses, piers or pilasters.

Explanation:
A may be reduced by $\frac{1}{2}$ B as at A'.
C = 1-10 D.

inch walls between buttresses or piers or pilasters shall not be used where the distance between buttresses or piers or pilasters is greater than eighteen feet. Sixteen-inch walls shall not be used between buttresses or piers or pilasters where the distance between buttresses or piers or pilasters is greater than twenty-four feet. Twenty-inch walls shall not be used between buttresses or piers or pilasters where the distance between the buttresses or piers or pilasters is greater than thirty feet.

(k) Where buttresses are used, they shall be so placed that the principal girders and trusses shall bear on them.

(l) If the loads carried by trusses and girders are supported by iron, steel, or reinforced concrete columns, then such buttresses as are herein described shall not be required except for the fireproofing of steel and iron columns. The walls between such columns shall be built as required by this Chapter, and said walls shall be anchored to such columns by metal anchors in every seven feet to the height of such column.

(m) A structural floor system shall extend from one wall to an opposite wall, and the walls shall be anchored to floor joists or girders or both with iron anchors placed opposite one another, secured to the same joists or girders in pairs, every seven feet or less of length of said walls. Where said joists or girders are of such length that it is not practicable to make them of one piece, then the several pieces shall be joined at each splice or joint by the tie plates or tie bars or other metal connections of the same strength as the anchors. Such anchors shall have not less than four-tenths of a square inch of metal in its smallest cross-sectional area. The spikes, bolts or screws, securing said anchors and tie plates, shall be of such number and size as to transmit the tensile strain which the anchor is capable of resisting into the joists or girders to which said anchors are connected. All pin anchors shall extend at least eight inches into the supporting masonry.

(n) The story height of buildings shall be the distance between structural floor systems or between such structural floor systems and structural roof systems and shall be as follows:

Where 12-inch walls are used, the story height shall not exceed 18 feet.

Where 16-inch walls are used, the story height shall not exceed 24 feet.

Where 20-inch walls are used, the story height shall not exceed 30 feet.

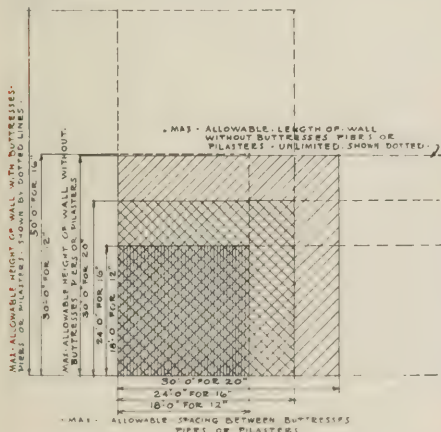


Fig. 18.

Explanatory diagram of maximum allowable height spacing and length of walls with or without buttresses, piers or pilasters.

(o) Where the story height is greater than thirty feet, the walls shall not be of less thickness than the following: The upper fifteen feet shall be not less than sixteen inches in thickness, and the walls shall be increased four inches in thickness at each interval of fifteen feet or fractional part thereof of height.

(p) Curtain walls in skeleton construction buildings may be built of hollow clay tile subject to the requirements and limitations of paragraph (c), Section 779 of this chapter, or may be constructed of reinforced concrete subject to the provisions and limitations of Section 766 of this chapter.

(q) The walls of buildings to be used for the purposes of Classes III and VI and not more than two stories in height may be of hollow clay tile or moulded hollow concrete blocks not thinner than the thickness herein required for brick walls, subject to the approval of the Commissioner of Buildings.

(r) Interior brick walls used to support fireproof floor construction, where brick walls are not required by this chapter, may be built thinner than the thickness required by the provisions of paragraph (a) of this section, in case the proportion between the thickness of such walls and the free height between floors does not exceed fifteen, and provided the unit stresses do not exceed the stresses allowed by this chapter, and provided further, that no such wall shall be constructed of a thickness less than twelve inches.

733. Ledges—Joist Supports.) (a) In buildings two stories or more in height wherever party walls or partition walls twelve inches or less in thickness are used for the support of wood joists in buildings of Classes I, II, IV, V, VII and VIII the joists shall be supported on ledges of brick formed by corbeling not less than four courses of brick and the upper course shall project four inches beyond the face of the wall, and the joists shall be protected from the bottom to the top of same for the distance of the projection of the corbel by solid brick work laid in mortar.

(b) Wherever iron or steel joist and girder boxes having five complete sides of iron, nowhere less than ¼-inch in thickness, are used, corbels and ledges as herein specified may be omitted.

(c) In buildings of every class where wood furring is used on brick walls, the brick between joists shall be projected from the bottom of the joist to the top of the joist for the full thickness of the furring and in no case shall such projection be less than two inches.

(See illustration on next page.)

734. Walls of Altered Buildings—Increasing Thickness of.) If the walls of a building are not of sufficient thickness to comply with the requirements of this Chapter for an enlarged or modified building, then the thickness of the existing walls shall be increased by building alongside of them a new wall, which shall not, however, be less in any part thereof than twelve inches thick, and which shall be increased in thickness by four inches for at least every forty feet in the height of such wall. Such new wall shall be laid in Portland cement mortar and shall be anchored to the old wall, but bonding with brick or masonry will not be considered as complying with this Chapter; and if an increase in the height of the building is contemplated, the wall from the top of the old wall shall be built jointly upon the new and old walls. If solid masonry buttresses are introduced in connection with such thickening and strengthening of existing walls, the intervening wall may be reduced to eight inches in thickness, provided such buttresses are sufficient in number and in area to make the resultant structure of equal strength with the solid wall already

specified. Provided, however, that steel or iron columns or beams may be used instead of such new wall, such columns or beams to be bolted or bonded to the existing wall in a manner satisfactory to and approved by the Commissioner of Buildings.

735. Walls—Party.) The provisions of the preceding section shall also apply to all cases where existing party walls are to be joined to for the erection of new buildings. But in the case of party walls, which at the time of their erection were built in

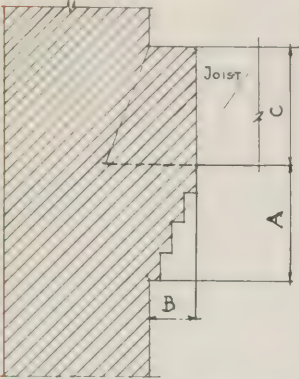


Fig. 19.

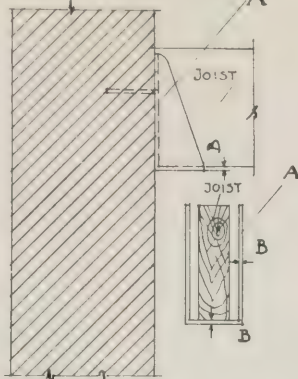


Fig. 20.

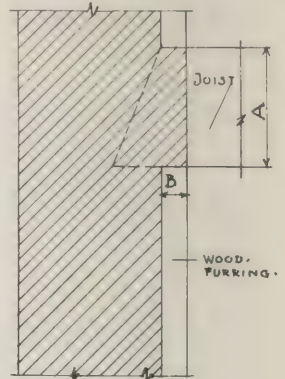


Fig. 21.

LEDGES—JOIST SUPPORTS.

Section 733a, b, c.

Fig. 19 (A) Corbelling to be not less than four courses of brick.
(B) Upper course shall project four inches.
(C) The joists shall be protected from top to bottom by brick.

Fig. 20 (A) Metal joist hanger allowable.
(B) $\frac{3}{4}$ inch metal required.

Fig. 21 (A) Brick shall project between joists
(B) Projection of brick to be two inches.

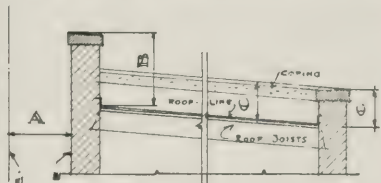


Fig. 22

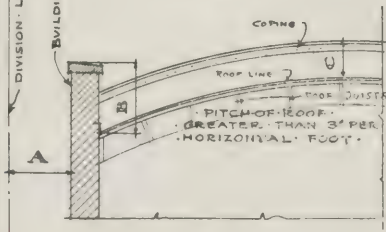


Fig. 23.

Fig. No. 22.

A—distance from division lot line to building line.

B—height of parapet wall above roof on division lot line side.

C—parapet wall on other sides when required.

Explanation:

If A is less than 3'0", B shall be 3'0".

C shall be not less than 18".

SECTION 737 D.

Fig. No. 23.

A—distance from division lot line to building line.

B—height of parapet wall above roof, with a greater pitch than 3" per horizontal foot, on division lot line side.

C—parapet wall on other sides when required.

If A is less than 3'0", B shall be 3'0".

C shall not be less than 18".

For exceptions where fireproof construction is used see ordinance Sec. 737 d, second paragraph.

accordance with the terms of the city ordinances then in force, such walls, if sound and in good condition, may be used without increase of thickness for any building not higher than and of the same class as the building for which the original wall was built.

736. Walls—Erection of—Walls and Skeleton Framework Securely Braced.) In the erection of buildings of masonry construction, no wall shall be carried up at any time more than two stories above another wall of the same building. The walls and skeleton framework of all buildings shall be kept securely braced and otherwise protected against the effects of the weather during all building operations.

737. Parapet Walls—When Required on Walls and Porches—Thickness and Height of.) (a) On all flat roof buildings parapet walls shall be erected, except as hereinafter provided, on all exterior walls and on all partition walls required by this ordinance by reason of the area of such buildings; provided, that such parapet walls may be dispensed with on any wall of a fireproof building, and on street and alley walls and on yard and court walls of buildings of other types where the entire framing and materials of the roof are strictly fireproof or where all portions of the roof nearer than fifteen feet to the lot line of such street or alley or bounding such yard or court are protected against fire by a continuous covering of porous or hollow tiles, not less than two inches thick and surfaced with mortar, on top of the roof boards.

(b) Such parapet walls may be eight inches thick wherever this ordinance permits the use of eight-inch walls; elsewhere they shall be not less than twelve inches in thickness.

(c) Such parapet walls shall extend at any point not less than three feet vertically above the roof on all such required partition walls and on all other walls within less than three feet of any division lot line and approximately parallel therewith; else-

where they shall extend not less than eighteen inches above the roof.

(d) On all buildings whose roofs have a greater pitch than three inches per horizontal foot, parapet walls, of thickness and height as above specified, shall be erected on required partition walls, on exterior walls approximately parallel with and less than three feet distant from a division lot line, and on walls abutting on another building. Provided, that such parapet walls may be dispensed with where the entire framing and materials of the roof are fire-proof or where the cornice and roof coverings are of incombustible material and the top of the roof boards is protected against fire for at least five feet up from such wall by a coating of plaster on porous or hollow tiles at least two inches thick; and further provided that such parapet walls and such protection against fire may be dispensed with on buildings of Classes III and VI,

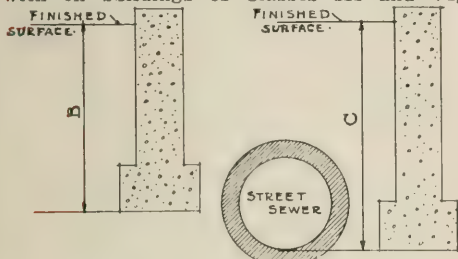


Fig. 24.

Fig. 25.

FOOTINGS.

Sections 740a, b.

Fig. 24 (B) Shall in all cases extend 4' 0" below finished grade at building, unless footings rest on bed rock—Sec. 740a.

Fig. 25 (C) Buildings 100 ft. or more in height; footings shall extend at least to a depth drained by sewer in adjacent streets and alleys.

Exception if sewer is greater than 10 ft. below sidewalk grade. Such foundation need not extend to a greater depth than 10 ft. if soil conditions are as per ordinance—Sec. 740b.

three stories or less in height when such buildings have cornices of incombustible material and roof coverings of slate or terra cotta roofing tile.

738. Allowable Stresses and Special Requirements for Foundations—Bearing on Various Soils.) (a) If the soil is a layer of pure clay at least fifteen feet thick, without admixture of any foreign substance other than gravel, it shall not be loaded to exceed 3,500 pounds per square foot. If the soil is a layer of pure clay at least fifteen feet thick and is dry and thoroughly compressed, it may be loaded not to exceed 4,500 pounds per square foot.

(b) If the soil is a layer of firm sand fifteen feet or more in thickness, and without admixture of clay, loam or other foreign substance, it may be loaded not to exceed 5,000 pounds per square foot.

(c) If the soil is a mixture of clay and sand, it shall not be loaded to exceed 3,000 pounds per square foot.

739. Foundations in Wet Soil—Trenches to Be Drained.) In all cases where foundations are built in wet soil, it shall be unlawful to build the same unless trenches in which the work is being executed are kept free from water by bailing, pumping, or otherwise, until after the completion of work upon the foundations and until all cement has properly set. In all cases a connection with the street sewer shall be established before beginning the work of laying foundations.

740. Foundations—Where not Permitted—Depth Below Surface—Independent of Underground Construction Owned or Controlled by the City.) (a) Foundations

must rest on hard sound soil, and shall not be laid or filled or made ground or on loam, or on any soil containing admixture of organic matter. Foundations shall in all cases extend at least four feet below the finished surface of the ground upon which they are built, unless footings rest on bed rock.

(b) Foundations shall in all cases extend at least four feet below the surface of the ground upon which they are built, and in the case of all buildings 100 feet or more in height, foundations shall extend at least to the depth drained by the street sewer in the adjacent streets or alleys; but if such sewers are at a greater depth than ten feet below the sidewalk grade, such foundations need not extend to a greater depth than ten feet, provided that sound, hard soil is found at that depth.

(c) Every building forty feet or more in height, hereafter erected, which is located adjacent to any street or alley containing any then existing water main, water tunnel, sewer, conduit, tunnel, subway or other underground construction, owned or controlled by the City, shall be so constructed that the foundation or superstructure thereof shall not be supported in whole or in part by any such underground construction.

741. Foundation Construction.) Foundations shall be constructed of stone, gravel or slag concrete, dimension stone or rubble stone, sewer or paving bricks, iron or steel imbedded in concrete or piles, or a combination of any of the same. All masonry foundations shall be laid in cement mortar.

742. Foundation of New and Old Walls.) In all cases where there is an increase in the thickness of walls, a new foundation shall be built in such a manner as to carry jointly both the new and old walls, and the soil under such foundations shall not be loaded beyond the limits specified in this Chapter.

All foundations shall be protected against the effects of frost, and cement mortar which has been affected by frost, shall not be used in building operations.

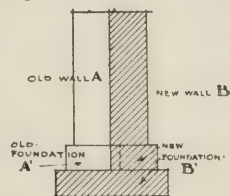


Fig. 26.

SECTION 742.

A—old or present wall.

B—new wall.

A'—foundation under old wall.

B'—required new foundation.

743. Foundations—Pile Borings Required—Safe Load Required—Fiber Stress.) (a) Where pile foundations are used, the Commissioner of Buildings may require auger borings of the soil to be made to determine the position of the underlying stratum of hard clay or rock. The heads of the piles shall be protected against splitting while they are being driven. The piles shall be sawed off to a uniform level at least one foot below Chicago datum after being driven, and the heads shall be imbedded in concrete or covered with a grillage so proportioned that in the transmission of the load from the structure to the pile the stresses in the materials shall not exceed that prescribed in this Chapter. The top of timber grillage shall be at least one foot below Chicago datum.

(b) The center of gravity of a pile foundation shall coincide with the center of gravity line of the load or loads which it carries.

(c) No pile of less than six inches diameter at small end shall be used.

(d) The safe load on a pile shall be determined by and shall not exceed the following formula:

$$P = \frac{2wh}{S+1} \text{ for steam hammer;}$$

$$S+1$$

$$P = \frac{2wh}{S+1} \text{ for drop hammer;}$$

In which formula

S=set in inches.

h=fall in feet.

w=weight of hammer.

P=safe load in pounds.

(e) The maximum load on a timber pile shall not exceed 50,000 pounds.

(f) A wood follower shall not be used in determining the safe load.

(g) Plans for pile foundations shall be submitted to the Commissioner of Buildings for approval and shall specify the least diameter of small end of piles, and no piles with smaller diameter of points than that specified for the job shall be used.

(h) There shall not be less than two rows of piles under all external party walls or other walls less than seventy feet high, and not less than three rows under all walls over seventy feet high, excepting under walls not exceeding fifty feet in height a single staggered row of piles may be used if other conditions of stability are complied with.

(See Special Ruling VII, Page 298.)

744. Concrete Piles Allowable—Compression—Tests—How Made. (a) Where concrete piles are used test piles shall be driven and loaded under the general direction of the Commissioner of Buildings.

(b) The allowable compression of concrete piles shall not exceed 400 pounds per square inch at a section six feet from the surface of the ground in immediate contact with the pile.

(c) These tests shall conform to the following regulations: Tests shall be made on at least two piles in different locations and as directed by the Commissioner of Buildings. Not less than three piles to be driven for each test. The pile to be loaded to be driven first, the second pile to be driven within six hours of the driving of the first, the third pile to be driven within twenty to twenty-four hours after the first. The two latter shall each be driven with centers not to exceed twice the greatest diameter of pile, from the center of the test pile.

(d) The tests shall not be started until at least ten days after the piles to be loaded are driven, except that piles that have been cast and set up before driving may be tested as soon as practicable after driving. The piles shall be loaded with twice the proposed carrying load of the piles.

(e) The settlement shall be measured daily until a period of twenty-four hours shows no settlement.

(f) One-half of the test load shall be allowed for the carrying load, if the test shows no settlement for twenty-four hours and the total settlement has not exceeded one one-hundredths of an inch multiplied by the test load in tons.

745. Steel Rails or Beams in Concrete. If steel or iron rails or beams are used as parts of foundations, they shall be entirely imbedded in concrete extending not less than four inches beyond the metal.

746. Allowable Stresses and Special Requirements for Masonry. (a) Allowable stresses in pounds per square inch on plain concrete and stone masonry shall not exceed the following:

Coursed rubble Portland cement mortar	200
Ordinary rubble Portland cement mortar	100

Coursed rubble lime mortar	120
Ordinary rubble lime mortar	60
First-class granite masonry, Portland cement mortar	600
First-class lime and sandstone masonry, Portland cement mortar	400
Portland cement concrete 1-2-4 mixture, machine mixed	400
Portland cement concrete 1-2-4 mixture, hand mixed	350
Portland cement concrete 1-2½-5 mixture, machine mixed	350
Portland cement concrete 1-2½-5 mixture, hand mixed	300
Portland cement concrete 1-3-6 mixture, machine mixed	300
Portland cement concrete 1-3-6 mixture, hand mixed	250
Natural cement concrete 1-2-5 mixture	150

(See Special Ruling V, Page 298.)

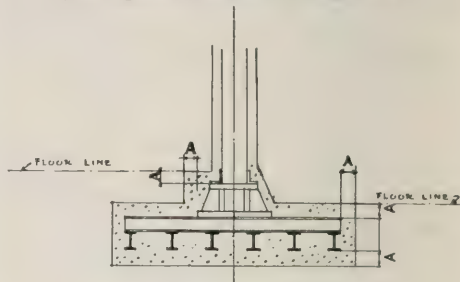


FIG. 27.

Section 745.

(A) Steel and iron rails and beams to be imbedded in concrete, extending not less than 4 inches beyond metal.

(b) Allowable compression in pounds per square inch on brick masonry shall not exceed the following:

	Lbs.
No. 1 paving brick, 1 part Portland cement, 3 parts torpedo sand	350
No. 2 pressed brick and sewer brick, mortar same as referred to above	250
No. 3 hard common select brick, Portland cement mortar, same as referred to above	200
No. 4 hard common select brick, 1 part Portland, 1 lime, 3 sand as referred to above	175
No. 5 common brick, all grades, Portland cement mortar	175
No. 6 common brick, all grades, good lime and cement mortar	125
No. 7 common brick, all grades, natural cement mortar	150
No. 8 common brick, all grades, good lime mortar	100

(c) Brick under Nos. 1 and 2 shall not crush at less than 5,000 pounds pressure per square inch of gross area.

(d) Brick under Nos. 3 and 4 shall not crush at less than 2,300 pounds pressure per square inch of gross area.

(e) Brick under Nos. 5, 6, 7 and 8 shall not crush at less than 1,800 pounds pressure per square inch of gross area. Sand lime brick of this crushing strength may be used where common brick is permitted.

(f) Isolated piers of concrete, brick, or masonry shall not be higher than six times their smallest dimensions unless the above unit of stresses are reduced according to the following formula:

$$P \text{ equals } C \left(1.25 \text{ minus } \frac{H}{20D} \right)$$

In which formula

P is the reduced allowed unit stress.

C is the unit stress in the above table.

H is the height of the pier in feet.

D is the least dimension of the pier in feet.

(g) No pier shall exceed in height twelve times the least dimension. Weight of pier shall be added to other loads in computing load coming on the pier.

747. Definition of Terms Used for the Construction of Walls.) (a) Wherever the terms masonry, masonry walls or masonry construction, incombustible wall, fireproof wall or wall of fireproof or incombustible material are used with reference to or in connection with the construction of walls in this chapter, such terms are hereby defined to mean solid walls of brick, stone or concrete, built of solid material, except such walls as are allowed under the provisions of Section 779 of this chapter. Where brick is used in the construction of any wall, the length and thickness of such brick may vary, but each brick must be at least three and seven-eighths inches in width.

(b) Ordinary rubble is hereby defined as masonry composed of unsquared stones laid without attempting any regularity of courses or bond.

Course rubble is hereby defined as masonry having approximately level joints; stones to be roughly shaped so as to fit approximately; joints in wall or pier to be leveled off every three (3) feet in height and to be well bonded.

First class masonry is hereby defined as masonry built of stones in regular courses, the bearing surfaces of which as well as ends, to be roughly tooled off and shall be laid with alternate headers and stretchers so as to secure perfect bond.

748. Ashlar Facing.) (a) Ashlar facing of masonry walls shall only be considered as part of wall for the purpose of carrying

weight, when it has a minimum bond as follows:

(b) Every second course to be a bond course, this bond course to extend into the backing a distance equal to the least thickness of ashlar. In addition to such bond, each stone in all courses shall be tied to backing by two galvanized iron anchors. No ashlar shall be less than four inches thick, nor shall the height of any stones exceed five times its thickness.

749. Soft Bricks—Where Not Permitted.) Soft bricks shall not be used in any part of a building where exposed to the weather, nor in external or internal piers of bearing walls.

750. Brickwork—Bonding of.) The bond of all brickwork shall be formed by laying one course of headers for every five courses of stretchers; provided that in the case of pressed brick facing, two headers and a stretcher may be laid alternately in every course or an equivalent number of full headers may be used in any other arrangement approved by the Commissioner of Buildings; and provided further, that pressed brick facing, when not counted as part of the bearing wall, may be laid with fewer or no header courses if anchored to the backing by metal ties of design, material, weight and quantity approved by the Commissioner of Buildings.

751. Bricks—How Laid.) All brick laid up in cement, or lime and cement mortar, shall be thoroughly drenched immediately before being laid unless laid in freezing weather. Both horizontal and vertical joints shall be filled with mortar in all kinds of brick masonry.

752. Allowable Stresses and Special Requirements for Timber.) The maximum allowable stresses in pounds per square inch on actual sections for timber shall be as follows

	Extreme Fibre Stress and Tension with Grain.	Compression with Grain.	Compression Across Grain in Build- ings Hereafter Erected.	Compression Across Grain in Existing Buildings.	Shear with Grain.
Douglas Fir and Long Leaf Yellow Pine....	1,300	1,100	250	400	130
Oak	1,200	900	500	600	200
Short Leaf Yellow Pine.....	1,000	800	250	300	120
Norway Pine	800	700	200	300	80
White Pine	800	700	200	300	80
Hemlock	600	500	150	300	60

The unit stress on timber posts shall comply with the following formula:

$$P = C \left(1 - \frac{L}{80D} \right)$$

In the above formula:

C equals compressive strength of timber with the grain as given in the table.

L equals length in inches.

D equals least diameter inches.

The maximum length of a timber post shall not exceed thirty diameters.

Timber columns shall not be used in buildings of greater height than twice the width of the building nor in buildings over one hundred feet in height.

753. Quality of Timber.) Timber used for building purposes shall be sound, well manufactured, close grained, free from wind shakes, or from dead, loose, decayed, encased or pitch knots, or knots and other defects that will materially impair its strength and durability.

754. Maximum Allowable Stresses and Special Requirements for Metals.) (a) The maximum allowable stresses in pounds per square inch in steel and iron shall not exceed the following:

	Rolled Steel.	Cast Steel.	Wrought Iron.	Cast Iron.
Tension on net section.....	16,000	16,000	12,000	.....
Maximum compression on gross section.....	14,000	14,000	10,000	10,000
Bending on extreme fibre.....	16,000	16,000	12,000	.....
Bending on extreme fibre tension.....	.....	.....	.....	3,000
Bending on extreme fibre compression.....	.....	.....	.....	10,000
Bending on extra fibres of pins.....	25,000	.....	.....	.....
Shear: shop driven rivets and pins.....	12,000	.....	.....	.....
Shear: field driven rivets.....	10,000	.....	.....	.....
Shear on rolled steel shapes.....	12,000	.....	.....	.....
Shear plate girder webs; gross section.....	10,000	.....	.....	.....
Shear on brackets .....	.....	.....	.....	2,000
Bearing, shop driven rivets and pins.....	25,000	.....	.....	.....
Bearing, field rivets	20,000	.....	.....	.....

(b) The allowable compressive stresses per square inch shall be determined by the following formulæ:

Steel	16,000—70—	$\frac{L}{R}$
Wrought iron	12,000—60—	$\frac{L}{R}$
Cast iron	10,000—60—	$\frac{L}{R}$

In the above formulæ:

L equals length in inches.

R equals least radius of gyration in inches.

(c) In no case shall the allowable compressive stress exceed that given in paragraph (a) of this section.

(d) For steel columns filled with, and encased in concrete extending at least three inches beyond the outer edge of the steel, where the steel is calculated to carry the entire live and dead load, the allowable stress per square inch shall be determined by the following formula:

$$18,000 - 70 \frac{L}{R}$$

but shall not exceed 16,000 pounds.

(e) For steel columns filled with, but not encased in, concrete the steel shall be calculated to carry the entire live and dead load. In this case the above formula may be used, but the allowable stress shall not exceed 14,000 pounds.

(f) Stresses due to eccentric loading shall be provided for in all compressive members.

(g) The length of rolled steel compressive members shall not exceed one hundred twenty times the least radius of gyration, but the limiting length of struts for wind bracing only may be one hundred fifty times the least radius of gyration. The limiting length for cast iron columns shall be seventy times the least radius of gyration.

(h) Cast iron columns shall not be used in buildings of greater height than twice the least width, or in buildings over 100 feet high.

(See Special Ruling VIII, Page 298.)

755. **Live and Dead Loads—Stress.** (a) Wherever the live and dead load stresses are of opposite character, only 70 per cent of the dead load stress shall be considered as effective in counteracting the live load stress.

(b) For stresses produced by wind forces combined with those from live and dead load, the unit stress may be increased fifty per cent. over those given above; but the section shall not be less than required if wind forces be neglected.

(See Special Ruling XIII, Page 299.)

756. **Riveting—Tension.** (a) In proportioning tension members the diameter of the rivet holes shall be taken one-eighth of an inch larger than the nominal diameter of the rivet.

(b) In proportioning rivets the nominal diameter of the rivet shall be used.

(c) Pin-connected riveted tension members shall have a net section through the pin-hole at least 25 per cent in excess of the net section of the body of the member and the net section back of the pin-hole, parallel with the axis of the member, shall not be less than the net section of the body of the member.

757. **Plate Girders—Flanges—Compression.** (a) Plate girders shall be proportioned either by the moment of inertia of their net section, or by assuming that the flanges are concentrated at their centers of gravity and a unit stress used such that the extreme fibre stress does not exceed 16,000 pounds per square inch, in which case one-eighth of the gross section of the web, if properly spliced, may be used as flange section.

(b) The gross section of the compression flanges of plate girders shall not be less than the gross section of the tension flanges; nor shall the stress per square inch in the compression flange of any beam or girder of a longer length than 25 times the width exceed.

$$20,000 - 160 \frac{L}{B}$$

In which formula

L equals unsupported distance and

B equals width of flange.

(c) The flanges of plate girders shall be connected to the web with a sufficient number of rivets to transfer the total shear at any point in a distance equal to the effective depth of the girder at that point combined with any load that is applied directly on the flanges.

(d) Webs of plate girders shall be provided with stiffeners over all bearing points, under all points of concentrated loading and elsewhere when required by good engineering practice.

Reinforced Concrete.

(See Special Ruling II and III, Page 294.)

758. **Reinforced Concrete—Definition—Plans.** The term "Reinforced Concrete" is hereby defined as any combination of metal imbedded in concrete to form a structure so that the two materials assist each other to sustain all the stresses imposed. Before a permit to erect any reinforced concrete structure is issued, complete plans and specifications shall be filed with the Commissioner of Buildings, showing all details of the construction, including detail of working joints, the size and position of all reinforced rods, stirrups or other forms of metal, and giving the composition and proportion of the concrete; provided, however, that permission to erect any reinforced concrete structure does not in any manner approve the construction until after tests have been made of the actual construction to the satisfaction of the Commissioner of Buildings.

(See Special Ruling III, Page 294.)

759. **Ratio of Moduli of Elasticity—Adhesion—Bond.** (a) The calculations for the strength of reinforced concrete shall be based on the assumed ultimate compressive strength per square inch designated by the letter "U" given in the table below for the mixture to be used.

(b) The ratio designated by the letter "R" of the modulus of elasticity of steel to that of the different grades of concrete shall be taken in accordance with the following table:

Mixture.	U	R
1 cement, 1 sand, 2 broken stone, gravel or slag	2,900	10
1 cement, 1½ sand, 3 broken stone, gravel or slag	2,400	12
1 cement, 2 sand, 4 broken stone, gravel or slag	2,000	15
1 cement, 2½ sand, 5 broken stone, gravel or slag	1,750	18
1 cement, 3 sand, 7 broken stone, gravel or slag	1,500	20

(See Special Ruling II, Page 294.)

760. **Unit Stresses for Steel and Concrete.** (a) The stresses in the concrete and the steel shall not exceed the following limits:

(b) Tensile stress in steel shall not exceed one-third of its elastic limits and shall not exceed 18,000 pounds per square inch.

(c) Shearing stress in steel shall not exceed 12,000 pounds per square inch.

(d) The compressive stress in steel shall not exceed the product of the compressive

stress in the concrete multiplied by the elastic modulus of the steel and divided by the elastic modulus of the concrete.

(e) Direct compression in concrete shall be one-fifth of its ultimate strength. Bending in extreme fibre of concrete shall be thirty-five one-hundredths of the ultimate strength.

(f) Tension in concrete on diagonal plane shall be one-fiftieth of the ultimate compressive strength.

(g) For a concrete composed of one part of cement, two parts of sand and four parts of broken stone, the allowable unit stress for adhesion per square inch of surface of imbedment shall not exceed the following:

	Pounds Per Sq. Inch.
On plain round or square bars of structural steel	70
On plain round or square bars of high carbon steel	50
On plain flat bars, in which the ratio of the sides is not more than 2 to 1....	50
On twisted bars when the twisting is not less than one complete twist in eight diameters	100

(h) For specially formed bars, the allowable unit stress for bond shall not exceed one-fourth of the ultimate bond strength of such bars without appreciable slip which shall be determined by tests made by the person, firm or corporation engaged in such construction work to the satisfaction of the Commissioner of Buildings, but provided that in case shall such allowable unit stress exceed 100 pounds per square inch of the specially formed bars.

761. Design for Slabs, Beams and Girders.) Reinforced concrete slabs, beams and girders shall be designed in accordance with the following assumptions and requirements:

(a) The common theory of flexure shall be applied to beams and members resisting bending.

(b) The adhesion between the concrete and the steel shall be sufficient to make the two materials act together.

(c) The steel to take all the direct tensile stresses.

(d) The stress strain curve of concrete in compression is a straight line.

(e) The ratio of the moduli of elasticity of concrete to steel shall be as specified in the table in Section 759.

(See Special Ruling II and IV, Pages 294, 297.)

762. Moments of External Forces.) (a) Beams, girders, floor or roof slabs and joists shall be calculated as supported, or with fixed ends, or with partly fixed ends, in accordance with the actual end conditions, the number of spans and the design.

(b) When calculated for ends partly fixed for intermediate spans with an equally distributed load where the adjacent spans are of approximately equal lengths:

Bending moment at center of spans shall not be less than that expressed in the following formula

$$\frac{WL^2}{12} \text{ for intermediate spans}$$

$$\text{and } \frac{WL^2}{10} \text{ for end spans.}$$

(c) The moment over supports shall not be less than the formula $\frac{WL^2}{18}$ and the sum

of the moments over one support and at the center of span shall be taken not less than

$$\text{the formula } \frac{WL^2}{6}$$

In the formulas hereinabove given "W" is the load per lineal foot and "L" the length of span in feet.

(d) In case of concentrated or special loads the calculations shall be based on the critical condition of loading.

(e) For fully supported slabs, the free opening plus the depth, for continuous slabs, the distance between centers of supports, is to be taken as the span.

(f) Where the vertical shear, measured on the section of a beam or girder between the centers of action of the horizontal stresses, exceeds one-fiftieth of the ultimate direct compressive stress per square inch, web reinforcement shall be supplied sufficient to carry the excess. The web reinforcement shall extend from top to bottom of beam, and loop or connect to the horizontal reinforcement. The horizontal reinforcement carrying the direct stresses shall not be considered as web reinforcement.

(g) In no case, however, shall the vertical shear, measured as stated above, exceed one-fiftieth of the ultimate compression strength of the concrete.

(h) For T beams the width of the stem only shall be used in calculating the above shear.

(i) When steel is used in the compression side of beams and girders, the rods shall be tied in accordance with requirements of vertical reinforced columns with stirrups connecting with the tension rods of the beams or girders.

(j) All reinforcing steel shall be accurately located in the forms and secured against displacement; and inspected by the representative of the architect or engineer in charge before any surrounding concrete be put in place. It shall be afterwards completely inclosed by the concrete, and such steel shall nowhere be nearer the surface of the concrete than $1\frac{1}{2}$ -inch for columns, $1\frac{1}{2}$ inch for beams and girders, and $\frac{1}{2}$ -inch, but not less than the diameter of the bar, for slabs.

(k) The longitudinal steel in beams and girders shall be so disposed that there shall be a thickness of concrete between the separate pieces of steel of not less than one and one-half times the maximum sectional dimension of the steel.

(l) For square slabs with two-way reinforcements the bending moment at the center of the slab shall not be less than that

$$\text{expressed in the formula } \frac{WL^2}{24} \text{ for inter-}$$

$$\text{mediate spans, and } \frac{WL^2}{20} \text{ for end spans.}$$

(m) The moment over supports shall not be less than the formula $\frac{WL^2}{36}$ and the sum

of the moments over one support and at the center of the span shall be taken not less

$$\text{than the formula } \frac{WL^2}{12}$$

In which above formula "W" is the load per lineal foot and "L" the length of the span.

(n) For squares or rectangular slabs, the distribution of the loads in the two directions, shall be inversely as the cubes of the two dimensions.

(o) Exposed metal of any kind will not be considered a factor in the strength of any part of any concrete structure, and the plaster finish applied over the metal shall not be deemed sufficient protection unless applied of sufficient thickness and so secured as to meet the approval of the Commissioner of Buildings.

(p) Shrinkage and thermal stresses shall be provided for by introduction of steel.

(q) In cases which it is claimed that equally good or more desirable system of reinforced concrete not covered by, or varying as to design from the conditions hereinafore given, he shall present to the Commissioner of Buildings plans and specifications giving in detail the construction and formulas used in his design, and the same to be such that they can be checked properly and kept on record by this bureau. He shall then make a destruction test or present evidence satisfactory to the Bureau that such test has been made, with full particulars of the result of the test. If said test shows that based on the specifications submitted, the construction has a factor of safety of four on total dead and live load and otherwise meets with the approval of the Commissioner of Buildings, the said system of reinforced concrete may be used in accordance with said plans and specifications.

Passed, April 27, 1925.

(See Special Ruling II, Page 294.)

763. Limiting Width of Flange in "T" Beams.) (a) In the calculation of ribs, a portion of the floor slab may be assumed as acting in flexure in combination with the rib. The width of the slab so acting in flexure is to be governed by the shearing resistance between rib and slab, but limited to a width equal to one-third of the span length of the ribs between supports and also limited to a width of three-quarters of the distance from center to center between ribs.

(b) No part of the slab shall be considered as a portion of the rib, unless the slab and rib are cast at the same time.

(c) Where reinforced concrete girders support reinforced concrete beams, the portion of floor slab acting as flange to the girder must be reinforced with rods near the top, at right angles to the girder, to enable it to transmit local loads directly to the girder and not through the beams.

(See Special Ruling IV & XVII, Pages 297, 300.)

764. Reinforced Concrete Columns—Limit of Length—Per Cent of Reinforcement—Bending Moment in Columns—Tying Vertical Rods.) (a) Reinforced concrete may be used for columns in which the concrete shall not be leaner than a 1:2:4 mixture and in which the ratio of length to least side or diameter does not exceed twelve, but in no case shall the cross section of the column be less than 64 square inches. Longitudinal reinforcing rods must be tied together to effectively resist outward flexure at intervals of not more than twelve times least diameter of rod and not more than 18 inches. When compression rods are not required, reinforcing rods shall be used, equivalent to not less than one-half of one per cent of the cross sectional area of the column; provided, however, that the total sectional area of the reinforcing steel shall not be less than one square inch, and that no rod or bar be of smaller diameter or smaller least dimensions than one-half inch. The area of reinforcing compression rods shall be limited to three per cent. of cross sectional area of the column. Vertical reinforcing rods shall extend upward or downward into the column, above or below, lapping the reinforcement above or below enough to develop the stress in rod by the allowable unit for adhesion. When beams or girders are made monolithic with or rigidly attached to reinforced concrete columns, the latter shall be designed to resist a bending moment equal to the greatest possible unbalanced moment in the beams or girders at the columns, in addition to the direct loads for which the columns are designed.

(b) When the reinforcement consists of vertical bars and spiral hooping, the con-

crete may be stressed to one-fourth of its ultimate strength as given in Section 759, provided, that the amount of vertical reinforcement be not less than the amount of the spiral reinforcement, nor greater than eight per cent. of the area within the hooping; that the percentage of spiral hooping be not less than one-half of one per cent. nor greater than one and one-half per cent.; that the pitch of the spiral hooping be uniform and not greater than one-tenth of the diameter of the column, nor greater than three inches; that the spiral be secured to the verticals at every intersection in such a manner as to insure the maintaining of its form and position, that the verticals be spaced so that their distance apart, measured on the circumference be not greater than nine inches, nor one-eighth the circumference of the column within the hooping. In such columns, the action of the hooping may be assumed to increase the resistance of the concrete equivalent to two and one-half times the amount of the spiral hooping figured as vertical reinforcement. No part of the concrete outside of the hooping shall be considered as a part of the effective column section.

765. Structural Steel Columns.) When the vertical reinforcement consists of a structural steel column of box shape, with lattice or battenplates of such a form as to permit its being filled with concrete, the concrete may be stressed to one-fourth of its ultimate strength as given in table in Section 759, provided that no shape of less than one square inch section be used and that the spacing of the lacing or battens be not greater than the least width of the columns.

(See Special Ruling X, Page 299.)

766. Curtain Walls in Skeleton Construction Buildings.) Buildings having a complete skeleton construction of steel or of reinforced concrete construction, or a combination of both, may have exterior walls of reinforced concrete eight inches thick; provided, however, that such walls shall support only their own weight and that such walls shall have steel reinforcement of not less than three-tenths of one per cent in each direction, vertically and horizontally, the rods spaced not more than twelve-inch centers and wired to each other at each intersection. All bars shall be lapped for a length sufficient to develop their full stress for the allowable unit stress for adhesion. Additional bars shall be set around openings, the verticals wired to the nearest horizontal bars, and the horizontal bars at top and bottom of openings shall be wired to the nearest vertical bars. The steel rods shall be combined with the concrete and placed where the combination will develop the greatest strength, and the rods shall be staggered or placed and secured so as to resist a pressure of thirty pounds per square foot, either from the exterior or from the interior on each and every square foot of each wall panel.

767. Bending and Elongation of Steel.) The bending and elongation of steel used in reinforced concrete construction shall conform to the following requirements: (a) Steel having a diameter of three-fourths of an inch or less shall be capable of bending cold ninety degrees over a diameter equal to twice the thickness of the piece without fracture; steel over three-fourths inch in diameter shall be capable of bending cold to ninety degrees over a diameter equal to three times the diameter of the piece.

(b) The material of reinforcement shall be such form that it will not elongate under working stress to exceed one fifteen-hundredth.

(c) Reinforcing steel used in reinforcing concrete construction shall not be painted,

but shall be free from all mill scale and loose rust.

768. Cement Tests.) (a) Only Portland cement shall be used in reinforced concrete construction. All cement shall be tested in car load lots when delivered, or in quantities equal to the same. Cement failing to meet the requirements of accelerated test shall be rejected.

(b) Pats of neat cement must be allowed to harden twenty-four hours in moist air, and then be submitted to the accelerated test as follows: A pat is exposed in any convenient way in an atmosphere of steam, and above boiling water, in a loosely closed vessel for three hours, after which before the pat cools, it is placed in the boiling water for five additional hours. To pass this test satisfactorily, the pat shall remain firm and hard, and show no signs of cracking, distortion or disintegration.

(c) Portland cement when tested shall have a minimum tensile strength as follows: Neat cement after one day in moist air shall develop a tensile strength of at least 200 pounds per square inch; after one day in air and six days in water shall develop a tensile strength of at least 500 pounds per square inch, and after one day in air and twenty-seven days in water, shall develop a tensile strength of at least 600 pounds per square inch. Cement and sand tests composed of one part of cement and three parts of sand shall after one day in air and six days in water, develop a tensile strength of at least 175 pounds per square inch; and after one day in air and twenty-seven days in water, shall develop a tensile strength of at least 240 pounds per square inch.

(d) A certificate that the cement used has been tested and has met the requirements of this section and that the tests have been made in accordance with the standard specifications and tests for Portland cement as adopted by the American Society for Testing Materials, and by the United States Government adopted 1904; revised 1908, 1909, 1917 and 1921—serial designation C-9-21, shall be furnished by the architect or engineer in charge to the Commissioner of Buildings.

769. Sand.) The sand to be used for concrete shall be clean, hard, coarse sand, of the grade known as torpedo sand, and free from loam or dirt, not less than 45 per centum shall be returned on a screen of 400 mesh to the square inch.

770. Stone.) The stone to be used in concrete shall be clean crushed hard stone or clean crushed blast furnace slag or gravel of a size to pass through a one-inch square mesh. If limestone or slag is used, it shall be screened to remove all dust; if gravel is used, it shall be thoroughly washed. Stone shall be drenched immediately before using. If slag is used, it shall be of such character that when made into concrete the concrete will develop a crushing strength equal to that specified for stone or gravel concrete.

771. Mixing.) All concrete shall be mixed in a mechanical mixer except when limited quantities are required, or when the conditions of the work make hand mixing preferable; hand mixing to be done only when approved by the Commissioner of Buildings. In all mixing, the separate ingredients shall be measured and shall be thoroughly mixed and must be uniform in color, appearance and consistency before placing.

772. Placing Concrete.) In filling in concrete around reinforcing steel, the concrete must be worked continuously with suitable tools, as it is put in place. Filling the forms completely and puddling afterward will not be permitted. In placing the concrete, the work shall be so laid out that partly set

concrete will not be subjected to shocks from men wheeling or handling material over it.

773. Concrete Placed in Freezing Weather.) When concreting is carried on in freezing weather, the material must be heated, and such provisions made that the concrete can be put in place without freezing. The use of frozen, lumpy sand, or stone depending on hot water used in mixing to thaw it out will not be permitted. All reinforced concrete shall be kept at a temperature above freezing for at least forty-eight hours after being put in place. All forms under concrete placed in freezing weather shall remain until all evidences of frost are absent from the concrete and the natural hardening of the concrete has proceeded to the point of safety.

774. Concrete Placed in Warm Weather.) Concrete laid in warm weather shall be drenched with water twice daily, Sunday included, during the first week after being put in place.

775. Cement Finish.) Cement finish added to the top of slabs, beams, or girders, shall not be calculated in the strength of a member unless laid integrally with the rough concrete. No greater unit stress shall be allowed on such cement finish than on the rough concrete.

(See Special Ruling IV, Page 297.)

(See Special Ruling IX, Page 298.)

(See Special Ruling XV, Page 300.)

776. Fireproof Concrete Construction—Acceptance.) Reinforced concrete construction will be accepted for fireproof buildings if designed as prescribed in this paragraph. The aggregate for such concrete shall be clean, broken stone or clean crushed blast furnace slag, or clean screened gravel, together with clean, coarse sand of the grade known as torpedo sand; stone, slag or gravel shall be of a size to pass through a screen of three-quarter inch square mesh. The minimum thickness of concrete surrounding the reinforcing members of reinforced concrete beams and girders shall be two inches on the bottom, and one and one-half inches on the sides of said beams and girders. The minimum thickness of concrete under slab rods shall be one inch; and all reinforcement in columns shall have a minimum protection of two inches of concrete except as hereinafter provided, if a supplementary metal fabric is placed in the concrete surrounding the reinforcing, simply for holding the concrete, the thickness of concrete under the reinforcing may be reduced by one-half inch, then such fabric shall not be considered as reinforcing metal.

(See Special Ruling IX, Page 298.)

777. Removal of Forms.) In no case shall the props and shores used in reinforced concrete construction be removed from under floors and roofs in less than two weeks, except as is provided herein. Column forms shall not be removed in less than four days. The centering from bottom of slabs and sides of beams and girders may be removed after the concrete has set for one week, if the floor has obtained sufficient hardness to sustain the dead weight of the said floor. No load or weight shall be placed on any portion of the construction until the concrete has fully set and the centers have been removed.

778. Tests.) The contractor for the reinforced concrete construction shall make load tests on any portion of the work within a reasonable time after erection, as may be required by the Commissioner of Buildings. Such tests must be made under the direction of the Commissioner of Buildings in his presence or in the presence of his representative, and must show that the construction will sustain a load twice the sum of the live and dead loads for which it

was designed, without any sign of failure. The construction may be considered as part of the test load. Each test load shall cover two or more panels and shall remain in place at least twenty-four hours. The deflection under the full test load at the expiration of twenty-four hours shall not exceed one eight-hundredth of the span. These tests shall be considered as tests of workmanship only.

779. Reinforced Terra Cotta Hollow Tile. (a) The term reinforced hollow tile is hereby defined to mean a system of hollow burned clay tile in combination with reinforced concrete, in which combination the hollow tile may be used to resist compressive and shearing stresses subject to the following provisions:

The provisions relating to reinforced concrete construction shall hold as far as applicable to this system.

All tile to be hard burned terra cotta tile of uniform quality, free from shrinkage cracks, with true beds and having an ultimate compressive strength of not less than 4,000 pounds per square inch of net area of surface tested.

The following stresses and values shall not be exceeded: Extreme fibre stress (compressive) on hollow tile, 500 pounds per square inch.

Shearing stress on hollow tile, forty pounds per square inch.

Adhesion between tile and 1:2:4 concrete or 1:3 cement mortar, twenty pounds per square inch.

Ratio of modulus of elasticity of steel to that of tile with cement mortar joints, 10.

(b) The hollow tile shall be thoroughly soaked with water at the time concrete is poured and be kept drenched for at least thirty-six hours afterwards. The joints between tiles shall be staggered, buttered and slushed full of mortar consisting of one (1) part of Portland cement and three (3) parts of clean, sharp sand, thoroughly mixed.

(c) Columns of solid terra cotta or of hollow terra cotta in which the sectional area of the open holes in each block shall not exceed twenty (20) per cent of the gross sectional area of such block, may be used for structural purposes provided the height of such column shall not exceed twelve times the least dimension.

The allowable stress shall not exceed 350 pounds per square inch and shall be subject to the reduction formula given in Section 746 in paragraph f.

All terra cotta tile used for construction of columns shall be hard burned terra cotta tile of uniform quality, free from shrinkage cracks, with true beds and having ultimate compressive strength of not less than 6,000 pounds per square inch of net area of cross section of samples tested.

Mortar used in setting terra cotta tile walls and columns to be composed of one (1) part Portland cement and three (3) parts clean, sharp sand, thoroughly mixed.

(d) All terra cotta tile must be thoroughly wet before using and when used in columns must be set on end with the voids running vertically and directly over each other, and with the webs in direct line of pressure.

All vertical joints must stagger and terra cotta blocks must be of proper dimensions to meet this condition as no broken tile will be allowed.

All work to be set plumb, with uniform horizontal joints, thickness to average three-eighths (3/8) of an inch. The minimum time which shall elapse between the finishing of the work and before any load is placed thereon shall be not less than seven days.

(e) Hollow tile may be used for building primary bearing walls, which are defined as walls that may be used to receive directly

the loads from floors or roofs in addition to their acting as partition walls, provided the proportion between thickness of wall and free height between the floors does not exceed fifteen (15) and the load including the weight of the construction does not exceed three hundred and fifty (350) pounds per square inch of net sectional area of tile, and shall be of the thickness specified by this chapter for brick walls. Hollow terra cotta tile may be used for exterior walls, but when so used the thickness and height of the work must conform to the dimensions required for brick walls in this chapter, but must in no case exceed four stories in height in any building. The thickness of walls shall be calculated as the outside dimensions of the tile and each tile shall be full thickness of wall. The thickness of the plastering is not to be included as a part of the thickness of the wall. Walls having a thickness of 4 inches may be used when the height does not exceed five (5) feet. The quality and gross sectional area of the tile and mortar and special provisions as to workmanship as specified for terra cotta columns shall apply to terra cotta tile walls.

(f) Fireproof storage bin, grain elevators and grain warehouses may be built in cylindrical form with terra cotta tile of such height, diameter and thickness as is allowed by safe engineering practices, provided that the material shall not be stressed in excess of the limits prescribed in this chapter for walls and columns.

(See Special Ruling XI, Page 299.)

780. Cinder Concrete. (a) Cinder concrete construction may be used for all buildings in which fire-proof construction is mandatory by this chapter, or where ordinary construction, mill construction or slow-burning construction may be used.

(b) Only clean, thoroughly burnt, steam boiler cinders, free from matter other than cinders may be used. The cinders used shall be of such size that they will pass through a one-inch square mesh. Cinder concrete piers or walls shall not be permitted to carry loads and shall not be given credit therefor.

(c) The ultimate compressive strength per square inch of cinder concrete shall be taken as not exceeding seven hundred pounds. The ratio of the modulus of elasticity of steel divided by the modulus of elasticity of cinder concrete shall be taken as thirty.

(d) There shall not be less than one part of Portland cement to seven parts of cinders and sand of the grade known as torpedo sand in cinder concrete. All other special requirements and methods of calculation for reinforced concrete as required in this chapter shall modify and regulate the use of cinder concrete in buildings.

(e) All steel and all metal pipe and conduits enclosed in cinder concrete shall be protected by a coating of cement grout or plastered with good lime mortar before the cinder concrete is placed.

(f) For fireproof construction, the minimum thickness of cinder concrete covering on structural metal shall be the same as required for brick or concrete covering for fireproof buildings by this chapter. In slow-burning or mill construction buildings, the minimum thickness of cinder concrete covering on structural metal shall be three inches on columns and two inches on beams, girders and other structural steel or iron members.

(g) Wherever cinder concrete is used for the covering of columns, beams, girders or other structural steel members of a building the cinder concrete covering shall have metal binders, or wire fabric, imbedded in and around said columns, beams, girders or other structural steel members. If wire is

used for said metal binders, it shall not be smaller than No. 8 gauge wire and shall be spaced not less than sixteen inches apart along the length of the steel member covered.

(h) Where cinder concrete construction is used for a building which, by this chapter, is required to be of fireproof construction, all parts that carry weights or resist strains, shall be made entirely of incombustible material, and all metallic structural members shall be protected against the effects of fire by cinder concrete proportioned, mixed, applied and secured as herein described.

(i) All other parts of a building of cinder concrete construction, built where fireproof construction is mandatory by this chapter, shall be built and made of the material required by this chapter for buildings of fireproof construction; provided, however, that cinder concrete as described herein, and of the same thickness elsewhere specified, may be used for all protective covering of structural metal, after such metal has been protected by a coating of cement grout or plastered with good lime mortar, as required by this chapter.

(Section 780, Sub-Paragraph II.)

Cinder Concrete Building Unit. (a) A cinder concrete building unit shall be defined to be a building unit composed of selected and graded screened cinder aggregate, which when mixed with other determined proportions of cinder aggregate of different selected size and with cement and water of determined proportions and which building unit during manufacture is immersed in a bath and which unit after curing will give a crushing test of not less than 1,800 pounds per gross square inch area for all solid load-bearing units and a crushing test of not less than 700 pounds per gross inch area for all hollow units in load-bearing walls and not less than 450 pounds per gross square inch area for all non-load bearing walls and which building units shall maintain a uniform crushing test per 1,000 blocks within a range of twenty per cent all to be above the minimum prescribed above, which said building unit shall have its acidity neutralized and be freed from sulphur to one per cent of the mass.

(b) Said cinder concrete building units will be accepted in masonry, masonry walls or masonry construction, incombustible walls, fireproof walls or walls of fireproof or incombustible material, sound deadening walls, or in exterior walls or partitions and curtain walls or as back-up units in walls, or as facings for pillars, pilasters or buttresses and for floors, or in primary bearing walls, or load bearing walls, where such primary or load-bearing walls are used to receive directly the loads from floors and roofs in addition to their normal function, provided that in the case of primary bearing or load-bearing walls the proportion between the thickness of wall and free height between floors does not exceed fifteen (15) feet, and the load, including construction load, does not exceed the stresses provided for, and shall conform to the thickness prescribed for number four common selected brick in wall.

(c) Cinder concrete buildings units of the usual or accepted type of hollow building units may be used in basement walls, enclosure walls, partition walls, curtain walls or self-supporting walls, or as back-up units, or in fireproof or incombustible walls, or sound deadening walls, and in any other construction where hollow building units of other type are permitted, provided, when used as a part of a wall greater in width than the unit used, or when used as a back-up unit the wall shall be bonded together in courses not farther apart than sixteen inches, and

the bond shall extend into the bonded wall not less than four inches, or a bond as provided in Section 750 of this Code may be used. In laying the bonded wall in other than the regular bond above equivalents for bonding may be used subject to the approval of the Commission. Header blocks may be used in making such bond.

(d) When said cinder concrete building units are used in places where they will come in contact with the earth they shall be protected by a water-proofing material to be approved by the Building Commissioner.

¹ Passed March 30, 1929.

780A. (a) Wherever in this Chapter XVII exterior walls, bearing walls, enclosure walls or piers are, at the option and choice of the person, firm or corporation constructing or causing to be constructed any building authorized to be constructed of brick, or stone, or concrete, or a combination of said materials it shall hereafter be lawful to construct said exterior walls, bearing walls, enclosure walls or piers of brick, or stone, or hollow clay building tile, or concrete, or of any combination of two or more of said materials subject to the following conditions and requirements.

(b) Wherever under authority of this section or of any other section or provision in this Chapter XVII contained hollow clay building tile, or any combination of hollow clay building tile and brick or stone or concrete or two or more of said materials is used in the construction of any such exterior walls, bearing walls, enclosure wall or piers, all such hollow clay building tile and all tile work of masonry in which hollow clay building tile is used shall be subject to the following conditions and requirements:

Height and Thickness of Walls.) The minimum allowable thickness of walls shall be the same as required for brick walls, when used under the same conditions. The walls of one-story one-family residences and the second-story walls of two-family residences may be eight (8) inches thick for the uppermost fifteen (15) feet, provided, however, that when gable construction is used an additional five (5) feet is permitted to the peak of the gable.

The height of tile self-supporting walls shall, in no case exceed forty (40) feet. All heights shall be measured from the top of the basement wall. Walls of hollow clay tile shall be supported at right angles to the wall face at intervals, not exceeding sixteen (16) times the wall thickness, by substantial piers, buttresses, pilasters, cross walls, or returns, at least two (2) feet deep when the limiting distance is horizontal, or by floors when the limiting distance is vertical. In buildings where the walls are supported by the framework at the floor lines, hollow tile or combinations of hollow tile with brick, stone or other masonry, giving wall thicknesses of not less than twelve (12) inches, may be used for the enclosure walls of buildings of any height.

Faced walls shall not be less thickness than is required for masonry walls of the type which forms the backing. Where bonded as provided for herein, the facing may be considered a part of the wall thickness. Brick or masonry facing shall be not less than three and three-quarters (3¾) inches thick.

Parapet and Basement Walls.) Parapet walls shall not be constructed of hollow clay tile on the inside faces of walls extending above the roof line. Basement walls shall not be built of hollow clay tile. Hollow tile shall not be used where it will come in contact with the earth; nor shall it be used below a plane six feet above the grade line.

Cornices.) The center of gravity of stone cornices shall be inside of the outer face of the wall. Terra cotta or metal cornices shall

be structurally supported from the roof of the building.

Bond.) Where two or more hollow units are used to make up the thickness of a wall, the inner and outer courses shall be bonded at vertical intervals not exceeding three courses (or not exceeding 16 inches) by lapping at least one cell completely over a cell in the unit below.

Brick Facing.) Brick facing shall be bonded to walls of hollow tile with at least one full header course in every six courses.

Stone Ashler Facing shall have at least 20% of the superficial area not less than 3% inches thicker than the remainder of the facing to form bond stones which shall be uniformly distributed throughout the wall. When some stones in every alternate course are at least 7½ inches thick, bonded into the backing at least 3% inches and at least 20 per cent of the superficial area of the wall is constituted of such bond stone uniformly distributed, the ashler facing may be counted as part of the wall thickness. Every stone not a bond stone and every projecting stone shall be securely anchored to the backing with substantial non-corrodible metal anchors.

Working Stresses.) The maximum allowable compressive stresses on faced walls due to combined live and dead loads shall not exceed the stresses prescribed herein. Where bonded to the backing as above provided for, the facing may be considered in computing the bearing strength.

Mortar.) No lime mortar shall be used in connection with hollow clay tile.

Portland cement mortar shall consist of one part Portland cement and three parts sand and an allowable addition of not to exceed 10 per cent of hydrated lime.

Cement lime mortar shall be composed of two parts Portland cement, one part hydrated lime and not more than four parts clean sand.

Natural cement mortar shall consist of one part natural cement, and not more than three parts clean sand.

All materials for mortar shall be measured by volume.

Piers.) Piers less than twenty-four (24) inches in length measured horizontally between the window frames shall be built up solid for the full story height except in skeleton construction where solid masonry is required for the height of the pier only.

Hollow tile for the purposes herein mentioned shall be subject to the following requirements:

Strength.) The ultimate compressive strength of hollow clay building tile for use in exterior walls, bearing walls, enclosure wall and piers when laid with the cells horizontal shall be not less than eight hundred (800) pounds per square inch of gross sectional areas for individual minimum. At least five representative specimens of tile shall be tested in the position they would occupy when laid in the wall.

The average ultimate compressive strength of hollow tile for exterior and bearing walls when laid in the wall with the cells vertical shall be not less than 1,400 pounds per square inch of gross sectional area. Five representative specimens shall be used for the test and they shall be tested in that position, and the individual minimum shall be not less than 1,000 pounds per square inch of gross sectional area.

The tile shall have the following minimum requirements determined as hereinafter specified:

Weight.) The average unit weight of hollow clay building tile used for exterior walls, bearing walls, enclosure walls and piers shall

be not less than as follows, allowing a toleration of five per cent (5%).

Size	No. of Cells	Weight
4x5x12	1 or 2	9 pounds
8x5x12	3	16 pounds

Tile irregular in shape or tile other than listed herein may be used providing that the webs and shells shall have a minimum thickness of not less than one (1) inch measured inside the scoring and that the minimum thickness of any web or shell shall be not less than one-quarter of the clear length between cross webs, or shells, measured on its longest side; and further provided that any hollow clay tile with a height greater than six (6) inches shall have not less than six cells and the webs and shells shall have a minimum thickness of one (1) inch measured inside the scoring.

Absorption.) The absorption of hollow clay tile for the purposes herein provided shall not exceed sixteen (16%) per cent of the dry weight of the tile based on a five-hour boiling test in accordance with the recommendations of the American Society for Testing Materials (or the five-hour boiling test Bureau of Standards).

Unit Stresses.) The thickness of the walls of materials and types herein permitted shall be sufficient at all points so that the stresses due to combined live and dead loads for which the building is designed shall not exceed eighty (80) pounds per square inch of gross sectional area.

All tile herein provided for shall bear the words "Load Bearing" and the initials or trade mark of the manufacturer. These marks shall be indented on the exterior of the tile and shall be plainly legible.

Concentrated Loads.) Beams, joists, or other concentrated loads, shall be carried on at least two courses of brick, or by steel bearing plates, or by five inches of solid concrete, extending at least eight (8) inches into the wall, and so designed that the stresses herein permitted shall not be exceeded. The space between joists shall be filled with solid masonry.

Chases.) No tile work shall be cut into for pipes nor conduits but chases may be built into the wall providing that the back of the chase shall be at least six (6) inches thick, or the chase may be built of solid masonry.

Skeleton Construction.

(See Special Ruling I, Page 294.)

781. Skeleton Construction.) (a) The term "Skeleton Construction" shall apply to all buildings wherein all external and internal loads and stresses are transmitted from the top of the building to the foundations by a skeleton or framework of metal or reinforced concrete.

(b) In metal frame skeleton construction the beams and girders shall be riveted to each other at their respective junction points. If columns made of rolled iron or steel are used, their different parts shall be riveted to each other, and the beams and girders shall have riveted connections to unite them with the columns. If cast iron columns are used, each successive column shall be bolted to the one below it by at least four bolts not less than ¼ inch in diameter, and the beams and girders shall be bolted to the columns. Bolt holes in flanges for connection from column to column shall be drilled. At each line of floor or roof beams, lateral connections between the ends of the beams and girders shall be made in such manner as to rigidly connect the beams and girders with each other in the direction of their length.

(c) All steel trusses shall be riveted and the steel work in buildings more than 100 feet high and in a building whose height exceeds twice its width shall be riveted.

(d) Wherever it is found impossible to rivet connections as herein described and such connections are bolted, cold rolled or turned bolts of exact fit and diameter in reamed holes may be used in place of rivets with the same allowable stresses as field driven rivets.

(e) All structural members which are temporarily bolted together shall be well bolted in every alternate hole.

(f) After the bases or base plates and columns have been set in place, both shall be protected by a covering of cement concrete applied direct to the metal, measuring not less than two and one-half inches thick from the extreme projection of the metal, filled solid into all spaces, and forming a continuous concrete mass from the grillage or other foundations to an elevation six feet above the floor level nearest the column base plate or column stool.

(g) All metal shall be clean and shall be free from loose rust and scale, and all metal except that to be embedded in concrete shall be protected with at least two coats of metal protecting paint.

(h) All structural details and workmanship shall be in accordance with accepted engineering practice.

(i) All trusses shall be held rigidly in position, both temporarily and permanently by efficient lateral and sway bracing.

Miscellaneous Provisions.

782. Porches—Verandas—Porticos—Construction of Inside Fire Limits. (a) The enclosing walls of porches, verandas, or porticos shall be of incombustible material on buildings inside the fire limits, except that where such porches, verandas, or porticos constitute part of a storm house or of a storm door enclosure, they may be of combustible material, provided, that they be not more than twelve feet high, nor occupy a greater frontage than two feet more than the width of the inner doors protected by such storm enclosure.

(b) On buildings more than three stories in height, porches hereafter erected, if of combustible material, shall not exceed one story in height. Where porches of incombustible material are continuous and extend fifty feet or more across the rear of buildings, there shall be a partition of incombustible material separating each fifty feet of porch from the adjacent porch.

(See Special Ruling XII, Page 299.)

783. Tanks on Roofs—Permits—Fees. It shall be unlawful for any person, firm or corporation to construct, maintain or allow, or permit to remain in or upon the roof of any building in the city, any tank of a larger capacity than four hundred gallons, unless such tank shall rest upon a good and sufficient foundation of solid brick or stone masonry, or upon iron girders set on steel plates which rest upon a good and sufficient foundation of solid brick or stone masonry, or upon iron or steel construction. No tank of a capacity exceeding four hundred gallons shall be constructed in or upon any building without first submitting for the approval of the Commissioner of Buildings a complete set of plans, showing the construction in detail of the supports and foundations of such tank. If such plans shall be satisfactory to the Commissioner of Buildings, they shall be approved by him. The owner or his agent or the contractor erecting such tank shall, before proceeding with the erection of such tank, procure from the Department of Buildings a permit for the sub-structure work, for which permit a fee of ten dollars shall be charged.

784. Door and Window Openings, When Protected in Buildings of Classes I, II, IV, V, VII and VIII—Iron Doors—Wired Glass Set in Metal Frames.)

(See Illustration, Sec. 470b).

(a) Where the distance from door to window openings in buildings of Classes I, II, IV, V, VII and VIII is less than thirty (30) feet from the opposite side of the established alley line and where the windows and doors of two or more areas of the same building which is required to be separated by dividing walls by this chapter, are on a court, every such window and door, distant less than thirty feet from another window or door of another such area and also where the doors and window openings are within fifteen (15) feet of an inside lot line, such openings shall be provided with windows and doors constructed of wire glass set in metal frames and sash; provided, further, that doors may be automatic rolling steel shutters or steel plate doors or metal-clad wood doors, and further provided that at least one of the first or ground floor doors must be a swinging door.

(b) Where iron doors are used to fulfill the requirements of this section they shall be made of sheet iron or steel, of not less than No. 14 U. S. gauge metal, and shall lap the wall at least one-half inch all around the opening, and the bottom shall fit the sill closely where it is not practicable to lap it. The frames and crossbars shall be made of one and one-half by one and one-half by one-fourth inch angles and in no case shall there be less than two crossbars, and where the doors are over six feet high, such crossbars shall be placed not more than two feet apart. Lever bars shall be made of one and one-half by three-eighths inch iron, extending at least one-third of the distance across the opposite leaf. The number and spacing of such lever bars shall be the same as the crossbars. Where hinges are used they shall be made of two by one-fourth inch iron, extending at least three-fourths of the way across the door. The number and spacing of such hinges shall be the same as is required for the crossbars. Pin bolt or eyes shall be one-half inch round and shall be securely fastened to the building.

(c) Where metal frames, metal sash and wired glass are used to fulfill the requirements of this section, the glazed portion of the frames and sash shall be set with fire-resisting glass such as is elsewhere herein defined. The glass must be supported by frames and sash and shall be retained by the structural part of the frame or sash independently of the material used for water-proofing purposes. Non-inflammable material only shall be employed for the structural members used for retaining glass in the sash. Frames and sash shall be made of sheet metal or of rolled steel sections. Frames shall be of such form as to be retained in the wall opening either with flanges of at least one and one-half inches in width or by fixed anchors of proper length spaced not exceeding twenty-four inches securely set into the wall. Sheet metal frames and sash shall be made of galvanized iron of not less than No. 24 gauge and of a quality soft enough to permit of necessary bending without breaking, or of not less than 20-ounce copper, or other metal of equal strength and durability and which will not melt at a lower temperature than copper. All joints shall be made with interlocking seams, securely riveted together, and in no case shall solder be used for other than weather-proofing purposes. The head of the frame shall be closed at the top and the piece forming this closure shall be securely fastened to each side at all points. The sill shall be filled with concrete or other incombustible material. Movable or sliding sheet metal sash shall have stiles and rails of thickness and of width at least one and three-quarter inches respectively, and shall be securely fastened together at each corner and so constructed that they will correspond with the construction of the frames at every place of contact. Where frames are made

of solid rolled steel sections the metal shall be not less than one-eighth inch in thickness securely riveted or locked together at all corners and junctions so as to possess sufficient strength and rigidity to withstand shipment, handling and installation without distortion. Where sashes are made of solid rolled steel sections the metal shall not be less than one-eighth inch in thickness excepting the removable members for retaining the glass and the weathering strips which shall not be less than one-sixteenth inch in thickness. The sash members shall be securely riveted or locked together at all corners and junctions so as to possess sufficient strength and rigidity to safely withstand the stresses occasioned by handling, installation, operation and by wind pressure. Frames and sash in the construction of which solid rolled steel section members are used shall have all their parts protected from the effects of rust and corrosion by a covering of durable enamel or by the application of two coats of approved mineral paint. All glazing of frames or sash shall be with wired glass at least, one-quarter inch in thickness. The exposed area of any single pane or light of glass measured on the inner side of the window shall not exceed seven hundred and twenty (720) square inches nor shall the width or length of any pane or light of glass exceed forty-eight (48) inches. Glass shall be held in position by a metal ledge on each side of same. Ledges on the back or inner side of the glass shall be at least three-quarter inches high for lights where the unsupported glass area is seven hundred and twenty (720) square inches and for glass of an unsupported area of less than seven hundred and twenty (720) square inches a reduction in height of the inside ledges may be made at the rate of one-sixteenth inch for each one hundred (100) square inches reduction of unsupported glass area, but in no case shall the height of the inside ledges be less than one-half inch. The ledges on the outer or weather side of the glass shall not be less than one-half inch in height for unsupported glass areas in excess of three hundred and fifty (350) square inches. For unsupported glass areas less than three hundred and fifty (350) square inches, the weather side ledge may be one-half the height of the inside ledge but in no case shall it be less than one-quarter inch high. Clearance between the edge of the glass and the bottom of the groove formed by the ledges shall not exceed one-eighth inch and all glass shall be set in suitable putty. Movable sash shall have stiles and rails so constructed that they will properly engage with the frame members at all points of contact, afford ample weather-proof qualities and not warp or bulge materially under heat or rapid cooling.

(d) Lifting or sliding sash shall be counter-weighted so as to balance and if doubling the sash weights shall be separated by parting strips in the weight boxes and the weights shall be accessible through the boxes. Such sash shall be provided with metallic sash chain, cord or tape, and smooth running sash pulleys securely riveted or bolted in place. The sash chain, cord or tape shall be of sufficient strength to withstand severe heat without parting and be thoroughly protected against moisture or corrosion. Sash shall be fitted into frame with suitable stops and parting beads of metal or their equivalent. Sash shall be removable. Meeting rails of the sashes shall be so constructed as to prevent the passage of heat and flame and shall be equipped with one or more substantial sash locks securely riveted or bolted in place.

(e) Horizontally pivoted sash and movable sash shall be provided with steel pivots at least three-eighths inches in diameter securely attached above the middle. Pivots shall work in substantial iron or steel eye plates bushed with brass and securely at-

tached in place. Sheet metal frames shall be reinforced where the pivots enter by riveting on one-eighth inch iron strips so drilled as to receive the pivots. Such sash must be provided with suitable stops and an effective attachment for holding them open or closed and with such substantial gravity locks or ledges that will be positive in action and hold the sashes tightly closed when exposed to heat. Where either sash is stationary or where two pivoted sashes are used the transom bar dividing such sash shall be so constructed that it will not warp or bulge materially under heat or rapid cooling. Rails or transom bars where used shall be made so as not to be easily affected by rust and to afford ample weatherproof qualities.

(f) Vertically pivoted sash shall comply generally with the requirements for horizontally pivoted sash and movable sash. They must be constructed in such a manner as to afford proper stiffness and so as to prevent material warping or bulging under heat or rapid cooling.

(g) Hinged sash or casement windows must be hinged with substantial iron or steel hinges securely bolted or riveted in place, and provided with substantial iron or steel latches or locks securely fastened in place. Such sash shall be constructed so as to fit the frame closely and afford ample weatherproof qualities at all points. It shall be provided with stops and fastenings that will prevent material warping or bulging under heat or rapid cooling.

(h) Where the area of wall openings is in excess of 5 feet by 9 feet, the metal frames containing the sash or glass must be reinforced at every point of division by not less than five-inch "I" beams securely fastened into the brickwork, proper allowance being made for expansion of the beams when heated. "I" beams shall be protected on the flanges with at least two inches of tile, concrete, or other material approved by the Commissioner of Buildings, and next to the web with at least two and one-half inches of such material, which thickness shall be increased on large beams. Metal frames shall be securely attached to the reinforcing members.

(i) Electro-glazed prism glass may be used in lieu of wired glass, when approved by the Commissioner of Buildings as to material and construction of same, providing the frames and sash of same comply with the requirements of this section for wired glass window frames and sash.

(j) In cases in which it is claimed that equally good or more desirable mode or manner of constructing and installing metal frames, metal sash and fire-resisting glass, other than specified in this chapter, can be used in the erection or alteration of buildings, the Commissioner of Buildings upon written application to him for a permit to use the same, shall cause a test to be made of such construction in a laboratory of recognized standing, and may appoint an architect or a fire prevention engineer to represent the City at such test. A requirement of testing said frame and sash shall be that it will be capable of withstanding exposure to fire on the weather side for one hour with temperatures rising gradually to at least fifteen hundred (1500) degrees Fahr. without loss of glass or material passage of flame, and immediately after exposure to such before-described fire conditions it shall be required to withstand application to the weather side of a stream of water at least seven-eighths inches in diameter applied from a distance of twenty feet at sixty (60) pounds pressure. The results of the test shall show also that the proposed material and construction will be equal or better in fire-resisting and structural qualities to a frame and sash of dimensions not greater than five feet by nine feet built as per re-

quirements of this section. All expenses of this test shall be borne entirely by the applicant for such permit. In the event of such examination and test being satisfactory to the Commissioner of Buildings he shall authorize the use of such frames and sash as a compliance with this section.

(k) This section shall not apply to frame buildings nor to buildings outside the fire limits twenty-eight hundred square feet or less in area, nor to buildings of Class I, one story in height, nor to buildings of Class II not more than two stories in height, nor to store windows in the first story, where the same are located on an alley and not more than sixteen feet from the street.

785. Window and Door Sills—Columns and Lintels Supporting Store Fronts—Incombustible.) (a) For buildings other than frame buildings window and door sills shall be made of incombustible material. Oak timber used for door sills and not less than eight inches thick by the full width of the wall in which such sills occur, shall, for the purpose of this Chapter, be counted incombustible.

(b) In buildings other than frame and excepting buildings of Classes III and VI, lintels shall be of incombustible material; provided that in one-story store front buildings columns and lintels may be of combustible material.

786. Courts and Light Shafts in Buildings.) (a) Every court or light shaft of every building shall be open and unobstructed from the bottom of such court to the sky, with the exception that fire escapes may be built therein, and such courts shall have walls constructed in the same manner as is required for the exterior walls of such buildings; provided, that no walls inclosing such courts are required on street or alley lot lines.

(b) All windows, doors or other openings in court walls, except as otherwise provided in this Chapter, shall have metal frames, metal sashes and metal doors, with the glazed portions thereof of wired glass.

787. Bay Windows—Light Courts—Shafts—Construction of.) (a) The walls of every bay window and every court in every masonry constructed building, except buildings of Class III, shall be built of brick or other fireproof construction throughout as required for exterior walls.

(b) The walls of every vent shaft of every masonry constructed building, except buildings of Class III, shall be built of masonry or a fireproof material not less than four inches in thickness supported by steel or iron.

(c) Every court, light shaft, or vent shaft in every building shall be open and unobstructed from the bottom of such court to the sky with the exception that fire escapes may be built in courts or light shafts, subject to all the provisions of this Chapter.

(d) All windows, doors, or other openings in court walls, except as otherwise provided in this Chapter, shall have metal frames, metal sashes and metal doors with the glazed portion thereof of wired glass.

788. Windows, Cleaning of—Safety Devices.) The owner or agent of every building in the city shall equip each and every window in any such building above the first story thereof with a suitable device or devices which will permit the cleaning of the exterior of each and every window in such building above the first story without danger to the person cleaning such windows, and such devices shall be of such pattern and construction as will reasonably and safely answer the purposes for which they are intended; provided, however, that if windows are of such construction that

they may be easily cleaned from the inside they need not be equipped with such devices.

(See Illustration, Sec. 740b).

789. Dividing Walls and Iron Doors—Openings Inserted.) (a) Wherever openings are to be inserted in dividing walls in buildings, where such dividing walls are required by reason of the large area of such building, or in dividing walls between two or more connected or attached buildings, they shall be provided with incombustible doors as follows:

(b) Such doors may be either sliding doors or swinging doors, and shall be so constructed, installed and maintained that they can be easily opened or closed from either side at all times by any person; provided, however, rolling steel shutters may be used when such openings are not used as exits.

(c) Every such door shall be equipped with a device containing a fusible link or other releasing arrangement of equal efficiency, approved by the Commissioner of Buildings. There shall be one of these immediately above the door opening and one above the opening near the ceiling. Where the ceiling is less than three feet above the door opening, the last mentioned fusible link or releasing device may be omitted, if the doors are so arranged that the operation of any one of the thermostats, or other releasing devices, will result in the closing of the doors on both sides of the walls. Fusible links, or other approved substitute,

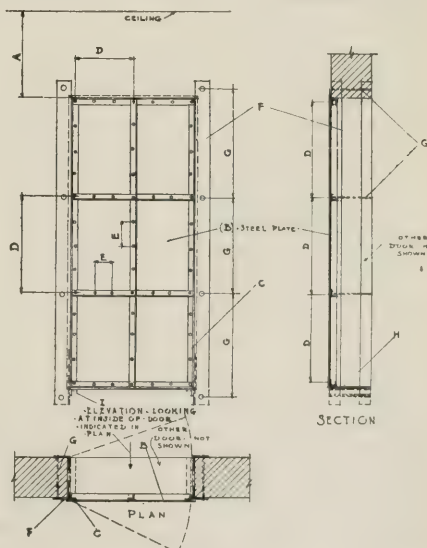


Fig. 28.

DIVIDING WALLS AND IRON DOORS—OPENINGS INSERTED.

Section 789c, f.

- (A) Distance to ceiling.
If A is less than 3' 0" fusible link at ceiling may be omitted.
- (B) Steel plate, No. 12 U. S. gauge or greater.
- (C) Continuous 2" x 2" x 3/8" Ls.
- (D) 2 x 2 x 3/8" Ls forming panels. Angles not less than 2' 0" apart.
- (E) Rivets spaced from 4" to 6" o. c.
- (F) Door frames 3 x 4 x 3/8" Ls (or alternate as by ordinance).
- (G) 3/4" bolts, not more than 2' 0" o. c. fastening frame to wall.
- (H) 1/2" iron or steel sill required.
- (I) Sill fastened to frame by 1 1/2 x 1 1/2 x 1/4" Ls on inner side of frame. (Sec. 789f).
- Exception: Sill plates may be omitted where floors are of concrete construction.

shall be made so that they will fuse or operate when subjected to a heat of 160 to 165 degrees Fahrenheit. If said doors are of steel plate, the plate or plates shall be of No. 12 U. S. gauge or greater thickness, with a continuous two by two by three-eighths inch angle iron frame extending all around the same and two by two by three-eighths inch panel bars not exceeding twenty-four inches apart, riveted to

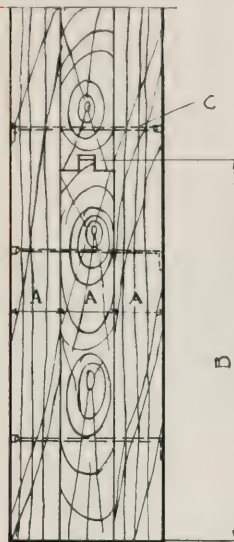


Fig. 29.



Fig. 30.



Fig. 31.

DIVIDING WALLS AND IRON DOORS—OPENINGS INSERTED—(Continued).

Section 789j.

Fig. 29. Tin-clad Doors.

(A) Three thicknesses of 13/16" required.

(B) Boards not wider than 8". Outside layers vertical and inside layer horizontal laid.

(C) Nails clinched as (C).

Fig. 30. Single locked tin plate seam.

Fig. 31. Double locked tin plate seam.

the plate of the door with not less than three-eighths inch rivets spaced four inches to six inches between centers. Pairs of swinging doors shall be so constructed that when the doors are closed, they will be of strength equal to that of a single door, and shall be so arranged that they will operate automatically. All doors shall be hung on wall frames of four by three by three-eighths inch angle iron or of four by three-eighths inch bar iron stiffened by one and one-half by one and one-half by one-fourth inch angles riveted on the back and fitting snugly to the wall. The frame shall be fastened together by three-fourths inch bolts extending through the wall, such bolts being not more than two feet apart. All doors to be made to fit closely to the wall frame on all sides. Lintels of door openings shall be made of brick, iron or concrete.

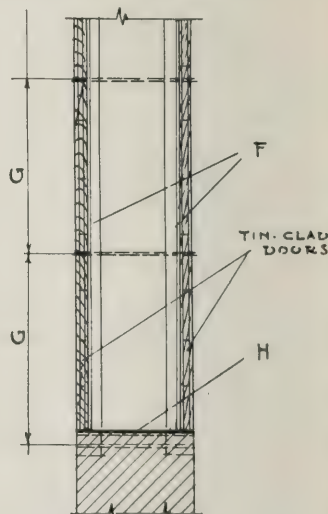
(d) Swinging iron doors shall swing on three wrought iron hinges made of two by three-eighths inch bar iron and shall be secured by at least three lever bars of one and one-half by three-eighths inch iron, working together and so arranged as to be operated on either side of the door.

(e) Sliding iron doors shall slide in channels at the top and bottom; bottom channels shall be formed by two angles two and one-half by three-eighths inch and one and one-half by one-fourth inch; top chan-

nels to be formed by two angles two by three-eighths inch and one and one-half by one-fourth inch; channels shall be securely riveted or bolted through the wall frame and where they extend beyond the wall frame shall be firmly bolted to the wall by expansion bolts. Track shall be without incline, of one-half by one-half inch iron securely riveted on the upper side of the angle iron channel. Hangers shall be of the anti-friction pattern and securely fastened to the door plate by at least four one-half inch bolts. Wheels shall be of cast iron three-fourths by four and one-half inches.

(f) Sills between iron doors shall be of one-fourth inch iron or steel with edges securely fastened to one and one-half by one and one-half by one-fourth inch angle iron or heavier, on the inner side of the wall frame. Where adjoining floors are of concrete construction, sill plates may be omitted.

(g) When tin-clad doors are used they shall be made of three thicknesses of thirteen-sixteenths inch seasoned, non-resinous wood, of good sound quality, free from sap and large or loose knots, tongued and grooved, dressed on both sides and not exceeding eight inches in width. The outside layers shall be vertical, the inside layer shall be horizontal; layers shall be securely fastened together by wrought iron clinch nails driven in flush and clinched so as to



SECTION

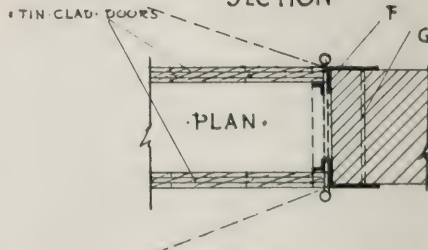


Fig. 32.

Section 789g.

Fig. 32. (H) 3/4 inch iron or steel sill.

(F) 3" x 5" x 3/4" L riveted to iron sill.

(G) 3/4 inch bolt 18" o. c.

Exception: Sill plates may be omitted where floors are of concrete construction.

leave smooth surfaces. The woodwork shall be thoroughly covered with terne plate tin of size fourteen by twenty inches, weighing not less than one hundred and thirteen pounds per box of one hundred and twelve sheets; all joints shall be locked one-half inch and nailed under seams, except on edges of door; vertical joints shall be double locked, horizontal joints single locked. Nails used to fasten tin shall be No. 13 gauge, flat head, full barbed wire, two inches long.

(h) Swinging tin-clad doors shall have three-eighths by two and one-half inch wrought iron hinges bolted to doors with four three-eighths inch bolts. Doors in excess of seven feet in height shall be provided with three hinges and have wrought iron wall eyes built in wall, or riveted to wall frame, or bolted through wall with three-fourth inch bolts. They shall have at least three level bars of one and one-half by three-eighths inch iron, working together; the latch shall be placed so it can be operated from either side of the door and provided with proper keepers bolted through the door, with the spring to insure latching; catches shall be made of one-half inch wrought iron securely bolted to wall or wall frame.

(i) Sliding tin-clad doors shall have tracks inclined three-fourths inch to the foot, made of three and one-half by three-eighths iron rolled steel, or round bars, or round pipes of equal strength, securely bolted through wall with three-fourths inch bolts. Hangers shall be made of three-eighths by three and one-half inch wrought iron attached by not less than one-inch bolts. Wheels shall be of malleable or wrought iron with not less than one and one-half inches bearing on axle. Doors over six feet wide shall have three hangers and shall be provided with necessary binders, chafing strips, bumpers and bumper shoes.

(j) Sills between tin-clad doors shall be of one-fourth inch iron or steel riveted to a three and one-half by five by three-eighths inch angle iron on each side of the wall; angle irons to be fastened together through the wall by three-fourths inch bolts spaced not to exceed eighteen inches apart; provided, that where adjoining floors are of concrete construction, sill plates may be omitted.

(k) Rolling steel doors used as dividing wall doors shall be made either of wooden slats covered with steel or bronze, or of number 20 U. S. gauge painted steel, or of number 24 U. S. gauge galvanized steel. The edges of such doors shall run in steel channels not less than one and one-half inches deep, and three-sixteenths of an inch in thickness.

(l) Such doors shall be hung on winding shafts and helical springs of sufficient strength to counterbalance the door at any position, and shall be equipped with a device to hold the doors in a closed position if the spring is destroyed. The head of the door opening shall have baffle plates of number 12 U. S. gauge steel, which shall be reinforced around the edges by one and one-half inch angles, to act as fire and smoke stops. The openings for such doors shall have steel frames and sills as herein required for steel swinging doors.

(m) Wherever incombustible doors are to be used in openings to vertical shafts for stairways, passenger and freight elevators, pipes, conduits, and in corridor and room partitions, they may be made of two thicknesses of wood and covered with tin as described in paragraph (g) of this section, or of No. 20 U. S. gauge steel with stiles and rails not less than one and three-fourths inch and panels one-quarter inch thick, and the interior of said doors shall be filled with asbestos or non-resinous wood; provided

however, that in fireproof buildings of Classes IIA, IIB, III, except when used in part as a stable and garage, IV, VI, and VIII, and in fireproof buildings of Class I, when equipped with an automatic sprinkler system, and when the occupancy does not constitute a special fire hazard in the opinion of the Chief of Fire Prevention and Public Safety, these openings, with the exception of openings to freight elevators, may be provided with incombustible doors consisting of a structure of clear, non-resinous wood not less than one and five-eighths inch thick assembled in the form of a core and protected on all surfaces with a pure long fibre asbestos fabric, weighing one and twenty-eight one-hundredths ounces per square foot, or other protective coating equally as incombustible and mechanically bonded therewith and veneered, or consisting of a structure of clear, non-resinous wood with panels not less than three-quarters inch thick and stiles and rails not less than one and five-eighths inch thick assembled in the form of a core and covered on all surfaces with an asbestos fabric and sheet steel, copper or bronze; provided, further, that nothing contained in this paragraph shall be construed as prohibiting the use of such incombustible doors as are described in paragraphs (c), (g) and (k) of this section and paragraph (b) of Section 784. The frames and trim shall be of materials as herein described.

(n) No glass panels shall be permitted in incombustible doors, except that in fireproof buildings of Classes I, IIA, IIB, III except when used in part as a stable or garage, IV, VI and VIII, doors to passenger elevators, stairs, halls, courts, fire escapes, corridor and room partitions, wired glass panels may be used not exceeding one thousand four hundred forty square inches in total area, no division of which shall exceed 720 square inches in area and no dimension of which shall exceed forty-eight inches in extent. Where an elevator or stairway is enclosed with incombustible partitions and doors for the purpose of obtaining credit for additional exits, no glass of any kind shall be permitted in these partitions or doors.

790. Metal or Reinforced Concrete Chimneys in Fireproof Buildings—Air Space.)

(a) Internal chimneys of rolled steel or iron may be built in buildings of fireproof construction, provided that the rolled steel shall be not less than three-eighths inch in thickness, except that the upper fifty feet of such chimney may be one-quarter of an inch in thickness, riveted in every joint, or of cast iron, providing same shall not be less than three-fourths inch in thickness and jointed by bell and spigot joints or flanged bolted joints. All joints in cast iron work shall be filled and pointed with fire clay. Such metal internal chimneys shall be securely and firmly anchored to the framing of such fireproof building at each floor line and at the roof. The lower part of each such chimney shall be lined with insulating lining for a height herein required for the respective area by Section 794 of this Chapter. The insulating lining shall be one of the linings described in Section 796 of this Chapter.

(b) Reinforced concrete not less than four inches in thickness may be used on the interior of fireproof buildings, provided the requirements for reinforced concrete and for reinforced concrete stacks elsewhere required by this Chapter shall be complied with.

(c) Internal metal or re-inforced concrete stacks on fireproof buildings shall be surrounded by continuous air space from the lowest story through the roof not less than four inches across at any point, and said air space shall be surrounded by brick, hollow tile, or reinforced concrete. No structural metal in such air space shall be without such fireproof covering.

791. Reinforced Concrete Chimneys—How Built.) Reinforced concrete chimneys in which the temperature of the gases is intended to exceed 750 degrees Fahrenheit, shall be lined with fire brick or magnesite or asbestos insulating lining for the height and in the manner elsewhere required by this Chapter. If the insulating is stopped anywhere below the top of a reinforced concrete chimney or if the cross section of such a chimney is changed, then the reinforcing shall be increased at such points sufficiently to prevent the formation of temperature cracks.

792. Tenement and Apartment House Boiler Chimneys.) Chimneys for the heating apparatus of tenement and apartment houses shall not be considered as flues used for domestic purposes.

793. Height of Chimneys Above Roof.) (a) The height of all chimneys and flues of stoves used for domestic purposes or open fireplaces shall be not less than five feet higher than the highest point of the roof of the building of which they are a part.

(b) The height of all chimneys and flues above the highest portion of the roof of which they are a part, where such chimneys or flues are used for other than domestic purposes or for open fireplaces, shall be determined by dividing the greatest diameter

of twenty-five feet of any wood tank, pent house, or roof house, on the same building of which such chimney shall be a part shall be at least as high as the top of said wood tank, pent house, or roof house. The tops of chimneys on ridge roofs shall be not less than three feet above the ridge.

794. Insulating Cavities—Where Required.) All flues having a greater area than four hundred square inches shall be lined on the inside with an insulating material, which lining shall start at least two feet below the smoke inlet and shall extend upwards for at least ten times the diameter of the flue, or if said flue is not circular or square in cross section for ten times the average diameter, when the flues are of brick, stone or concrete, said insulating lining shall be fire clay brick or fire clay blocks, and if such bricks or blocks are four inches or more in thickness, they may be considered as a portion of the thickness required for the surrounding walls. The walls surrounding chimneys having an area greater than four hundred square inches shall have an insulating cavity not less than three inches wide surrounding the inner four inches of fire brick or fire clay blocks, for not less than the height required above for insulating lining and said inner core shall be built independent of the surrounding brick work and shall be free to expand or contract.

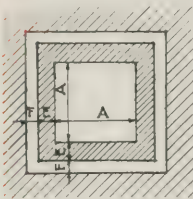


Fig. 33.

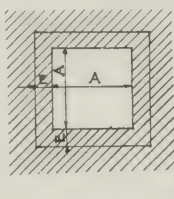


Fig. 34.

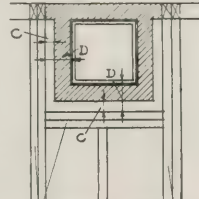


Fig. 35.

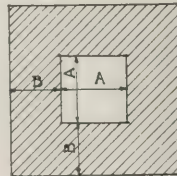


Fig. 36.

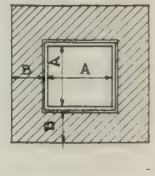


Fig. 37.

CHIMNEYS—INSULATING CAVITIES WHERE REQUIRED.

Section 794.

Figs. 33, 34 (A) Area of flue.

(E) Insulating lining.

(F) Insulating cavity.

Explanation: If A is more than 400 sq. in. an insulating lining (E) is required—(see Sec. 797 for further details). If A is more than 400 sq. in. the walls surrounding shall have an insulating cavity F not less than 3" wide.

If E in Fig. 34 is of fire brick of 4" or more in thickness it may be considered as a portion of thickness required for walls surrounding.

Section 797, Framing Around Chimneys.

Fig. 35. (C) Is distance joists or timbers are to be kept away from walls of chimneys = 2".

(D) Is distance to be kept away from inside of flue lining = 7".

Section 800. Walls Forming Smoke Flues.

Fig. 36. Shows chimney without flue lining.

If A = 144 or less, B = 8".

If A = more than 144 and not more than 600, B = 12".

If A = more than 600, B = 16".

For exceptions see ordinance, Sec. 800.

Fig. 37. Shows Chimney with flue lining, not less than 3/4" thickness.

If A is 144 sq. in. or less, walls surrounding may be (B) or 4".

If A is more than 144 sq. in. and not more than 300 sq. in. B = 8".

If A is more than 300 and not more than 600. B = 12".

If A is greater than 600, B = 16" (exceptions and reductions being stated in Sec. 800).

In inches by four, and the quotient thereby obtained in terms of feet, with five feet added, shall be the minimum height from the tops of such chimneys and flues above the highest portion of roof of the building. In no case shall the height of any chimney or flue be less than five feet above the roof of the building of which it is a part.

(c) Where a wooden tank, pent house or roof house is on the same building with a chimney, the required height of any such chimney above the roof of the building shall be not less than two-thirds of the sum of the horizontal distance between the chimney and such tank, pent house or roof house added to the vertical distance between the top of such tank, pent house, or roof house and a horizontal plane through the top of the chimney. The tops of chimneys within a radius

795. Metal Chimneys in Buildings of Ordinary Slow-Burning or Mill Construction.) Interior stacks or smoke flues of metal shall not be used in buildings of ordinary or slow burning or mill construction, unless they are surrounded by self-supporting brick or re-inforced concrete walls of the thickness herein required for flues of the respective area; provided, however, that if an interior smoke pipe of steel of not less than three-eighths inch in thickness riveted in every joint, or an interior smoke pipe of cast iron not less than five-eighths inch in thickness is used, then the brick work required inside of the insulating cavity of a stack may be omitted, but such metal linings shall be lined with such insulating material for the height herein elsewhere required for stacks. If a chimney or stack

is not a part of the walls of such a building, it shall be designed as an isolated chimney as required by Section 799 of this Chapter.

796. Insulating Material for Metal Chimneys and Metal Stacks.) (a) Fire clay brick or fire clay blocks may be used for the insulating lining of metal chimneys and stacks but not of a lesser thickness than two inches. The material shall be increased in thickness or supported on structural steel ledges and the material shall be stressed not to exceed the safe limits of stress elsewhere herein fixed for the material, or metal chimneys and metal stacks may be lined with blocks of magnesia insulation or with fused asbestos board insulation, or metal stacks or chimneys may be lined with any other insulating material tested and approved by the Commissioner of Buildings.

(b) Magnesia block insulation shall contain not less than 45 per cent of magnesia and 50 per cent asbestos fibre formed into blocks not less than 1½ inches in thickness by hydraulic pressure. After said magnesia blocks have been set, they and all metal bands and ties exposed with the flue shall be plastered with cement not less than one-half inch in thickness on one and one-half inch blocks, and one-fourth inch in thickness on one and three-fourths inch and thicker blocks.

(c) Fused asbestos board shall be made of alternate flat and corrugated sheets of asbestos board, cemented together and fused under a heat of not less than 1,000 degrees Fahrenheit to a minimum thickness of 1½ inches. After said fused asbestos boards have been set into the flues, they and all exposed metal bands or ties shall be pointed with cement.

(d) Such magnesia blocks, fused asbestos boards, pointing cement and any other insulating material approved by the Commissioner of Buildings shall resist the disintegrating, dissolving, or diminishing action of moist steam and the acid and gaseous fumes present in the flue at any degree of heat obtainable by the combustion of the fuel used.

797. Chimneys — Interior — Framing Around.) In case of chimneys which are enclosed, or form part of the interior of any building, no joists or girders shall rest or be supported on the walls of such chimney, and the framing around chimneys of all kinds shall be so constructed that in no case will any joists or timbers be placed nearer than two inches from the outside face of walls of flues, and in no case shall the distance from the inside of any flue to any joists or timbers be less than seven inches.

798. Chimneys — External Location of.) (a) Chimneys built outside of the walls of buildings shall not encroach upon any street or alley, and shall be built as follows:

(b) If at least one side of such chimney abuts entirely upon the wall of an existing building and the chimney is throughout its entire length securely and firmly anchored to the walls of such existing building, the wall of such chimney may be built of hollow tiles, in which case, however, it shall have a cast iron base, lined with fire brick, extending to a height of at least ten feet above the street or alley grade.

(See Special Ruling XVI, Page 300.)

799. Chimneys—Isolated—Stress Requirement.) Isolated chimneys shall be so designed and constructed that the stress in every part thereof, due to the weight of the chimney itself and from wind pressure, shall not exceed the safe limits as provided in this Chapter for the material used.

800. Walls Forming Smoke Flues.) The walls forming smoke flues of one hundred and forty-four square inches area or less

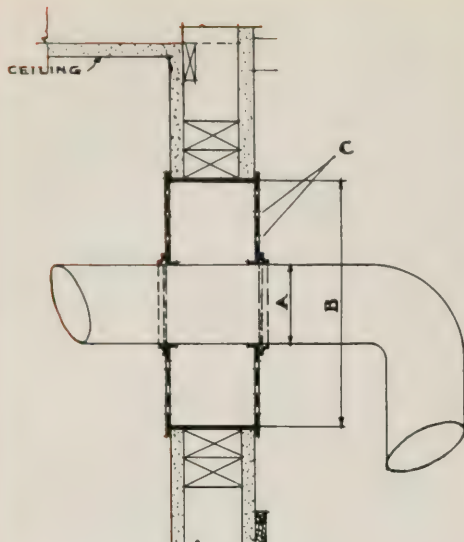
shall be of brick, concrete, stone, or of any one of these and burnt fire-clay flue tile lining, and such flue linings shall extend from the lowest opening to a distance of at least two feet above the roof joints. If only one of the above materials is used it shall not be less than eight inches in thickness. Provided, however, that such flues having walls at least three inches in thickness of continuous concrete or interlocking or rabbited joint concrete sectional flues may be used without burnt fire-clay flue tile linings. If any one of the above materials is used in combination with burnt fire-clay flue tile lining it shall be not less than four inches in thickness, and the burnt fire-clay flue lining shall be not less than three-fourths inches in thickness, and built as herein described. The walls forming smoke flues of more than one hundred and forty-four square inches area and not more than three hundred square inches area shall be of brick, concrete, stone, or any one of these and burnt fire-clay flue tile lining. If any of the above materials is used alone, it shall be not less than thirteen inches in thickness. If any one is used in combination with burnt clay flue tile lining, it shall be not less than nine inches in thickness and the fire-clay flue tile lining shall be not less than three-fourths inch in thickness and built as herein required. The walls forming flues having an area greater than three hundred square inches and less than six hundred square inches shall be built of one of the materials described above not less than twelve inches in thickness, and flues having an area greater than six hundred square inches shall have walls of one of the materials described above not less than sixteen inches in thickness, and these walls may be reduced to twelve inches in thickness at a point not less than fifty feet above the top of the breeching; provided, however, that the material of which all chimneys are constructed shall be so proportioned that it will not be subjected to a greater stress than elsewhere herein fixed as the maximum safe stress for such material.

801. Ventilating Ducts — Chutes — Walls Forming.) Walls forming ventilating ducts and rubbish and ash chutes shall be constructed in accordance with the regulations governing the construction of smoke flues elsewhere herein contained. Walls forming ventilating ducts shall not be less than four inches thick, and when the ventilating duct is larger than two hundred and sixty square inches the walls shall be not less than eight inches thick.

802. Smoke Pipes Passing Through Partitions.) In buildings hereafter erected it shall be unlawful to allow smoke pipes of greater diameter than six inches to pass through a combustible partition. Where a smoke pipe of six inches or less passes through a combustible partition it shall be surrounded by a ventilated thimble of incombustible material or by incombustible material with a diameter at least eight inches greater than the diameter of the pipe.

803. Boilers — Location of — Permit for.) In all cases, boilers shall be so placed as to give ample room between any ceiling, wall or partition to connect or operate any valves or pipes or other connections used on such steam boilers. The size, number and location of boilers to be installed in any building shall be marked on the plans and, except in buildings of Class III, approved by the Department for the inspection of Steam Boilers and Steam Plants, and by the Department of Health before a permit is issued by the Department of Buildings for the erection of such building.

804. Foundry Cupolas — Construction of Charging Floors and Roofs—Height Above Roof.) There shall be no combustible material used in the construction of a charging



SECTION

Fig. 38.

SMOKE PIPES PASSING THROUGH PARTITIONS AND WOOD WORK AROUND.

Section 802.

- (A) Diameter of smoke pipe, 6" or less.
- (B) Diameter of thimble required 8" greater than diameter of smoke pipe.
- (C) Ventilation holes required.

floor or a roof within thirty-six inches of the foundry cupola. Where the charging floor is less than eight feet above the dump floor no combustible material whatever shall be used in the construction of such charging floor. Foundry cupolas shall extend twenty-five feet above the highest point of any roof within a radius of forty feet from such cupola, unless such roof is of metal or fireproof construction.

805. Cornices — Eaves — Gutters — Pipes from Roof.) (a) Wood shall not be used for any purpose in connection with cornices and eaves on any building more than fifty feet in height. The entire exterior covering of cornices and eaves of buildings hereafter to be erected within the fire limits shall be of incombustible material.

(b) Wherever sheet metal cornices or eaves are used, their entire exterior covering shall be of metal or other incombustible material approved by the Commissioner of Buildings. Bracket supports for same shall be firmly secured to the wall at least every four feet, and the walls shall be carried full height under and behind same throughout their entire length.

806. Towers, Domes and Spires—Construction of.) Towers, domes and spires may be built on top of the roofs of buildings, but shall not occupy more than one-quarter of the street frontage of any building. Such towers, domes, or spires, if any part thereof is built to a height of more than fifty feet and less than ninety feet, shall be of slow-burning construction, and, if of a greater height than ninety feet above the sidewalk, shall be of fireproof construction; and, in all cases where the area of such tower, dome, or spire exceeds one hundred square feet, its supports shall be carried down to the ground, and if the structure supported is more than fifty feet and less than ninety feet high, it shall be of slow-burning construction, and, if more than

ninety feet high, of fireproof construction. No tower, dome, or spire shall exceed thirty-six hundred (3,600) square feet in area, and in no case shall the area exceed fifteen per cent of the total area of the building on which it is erected, nor shall the height of any tower, dome or spire exceed four hundred feet measured from the established inside grade.

807. Structures—Construction and Limitations of.) All structures built within the City other than those otherwise specifically provided for herein shall be designed and constructed according to established engineering practice, and shall comply with the provisions of this section. No structure of frame or mill construction within the fire limits shall exceed 35 feet in height from the ground to the highest point thereof. No structure of mill or frame construction outside the fire limits shall exceed the height of 45 feet from the ground to the highest point thereof.

All structures over thirty-five feet in height within the fire limits, and all structures over forty-five feet in height outside the fire limits shall be built of structural steel, concrete or masonry; provided, however, that viaducts or runways to be used for the purpose of transferring livestock from one building or place to another may be built of wood not to exceed eighty feet in height either within or without the fire limits.

If it is desired to enclose any structure, such structure shall be enclosed with concrete or masonry walls, or incombustible material of such construction as shall be approved by the Commissioner of Buildings; provided that structures outside the fire limits not exceeding 2,800 square feet in area, or 45 feet in height, may be enclosed with combustible material.

In every structure contemplated by this section safe and adequate means of ingress and egress shall be provided for persons employed in and about the same.

All structures whose height exceeds twice their least dimensions at their base shall be so designed as to safely resist a wind pressure of 30 pounds per square foot of surface exposed to the action of the wind.

808. Skylights—Construction of—Glass in.) (a) Any skylight on the roof of any building less than ninety feet in height, other than a frame building, shall have the sides, sashes and frames constructed of metal, or of wood, metal clad on all exterior surfaces. Any skylight on a building more than ninety feet in height shall be entirely of incombustible material.

(b) Every skylight shall be provided with ventilation opening of an area of at least three per cent of the base area of the skylight.

(c) The glass in all such skylights, except in buildings in Classes III and VI, not exceeding three stories in height, shall have at least six inches over same a strong wire netting with wire not lighter than number twelve gauge, galvanized after weaving, and mesh not coarser than one by one inch, unless the glass contains a wire netting within itself. Supports for screen shall not be less in size than the bars supported and of the same material.

809. Inclosures upon roof.) Skylights, inclosures for water tanks and inclosures for elevator machinery, the construction of all of which inclosures shall be entirely of incombustible material, shall be permitted to be erected on the roofs of all buildings more than fifty feet and less than one hundred feet high; provided, however, that the roofs of same may be built of mill or slow-burning construction.

810. Roof—Construction of—Pitch of.) Buildings, other than frame buildings when permitted by this Chapter, less than fifty feet in height with roofs which have a slope of more than three inches per horizontal foot, shall have the roofs covered with incombustible material. Buildings more than fifty feet and less than one hundred feet in height with roofs which have a slope greater than three inches per horizontal foot and which are of timber construction, shall have such roofs covered with an incombustible covering upon the roof boards, which shall be made either of mortar or porous terra cotta or plaster boards or other incombustible material, which shall be at least two inches thick. Where this covering is placed upon the roof boards wooden strips shall be inserted, which shall be securely fastened to the wooden structure at regular intervals between the incombustible covering and a weatherproof covering of incombustible material.

811. Roofs—Shingle, Gravel or Composition.) (a) The use of shingles or other forms of combustible roof covering on buildings erected or altered otherwise than is provided in Section 871, within the fire limits, is prohibited, except as hereinafter provided. In existing frame buildings not more than three stories high, the shingle roofs may be repaired with shingles or other materials.

(b) Roofs, the slope of which is not more than three inches per foot horizontal, and the covering of which is made of a composition of felt and gravel, shall be considered incombustible under the provisions of this Chapter, and may be used upon buildings of all classes. Other forms of composition roof shall be permitted if expressly approved as an incombustible roof by the Commissioner of Buildings.

812. Buildings—Height of—Parapet Walls—Roof Houses—Housing Tanks—Skylights and Scuttles.) (a) The limits of heights of buildings heretofore given for non-fireproof buildings shall be the perpendicular distance from the inside sidewalk grade of the street nearest the building to the highest point of the roof thereof. Where such street grade varies, the mean or average grade thereof opposite the building shall be the data from which such height is measured.

(b) The height of a fireproof building shall be the perpendicular distance from the inside sidewalk grade of the street nearest the building to the highest point of the external bearing walls. Where such street grade varies, the mean or average grade thereof opposite the building shall be the data from which such height is measured.

(c) No building shall be erected in the City of greater height than two hundred sixty feet. The erection of parapet walls or of balustrades constructed entirely of incombustible material shall be permitted above the roof level of buildings of all classes, in addition to the height fixed herein for the same.

(d) Roof houses for elevators, tanks, skylights, stairs or scuttles may be built above the height of the main roof.

813. Basement—Defined.) The upper surface of the floor of the first story of buildings of every class excepting Classes VI and VIII shall be not more than ten feet three inches above the inside sidewalk grade of the street nearest the building and that portion of the building below said floor shall be designated as the basement of the building of which it is a part.

Note: See Section 634 (h).

814. Sub-basements and Cellars—Construction of.) (a) No building shall have more than one basement or cellar of ordinary or slow-burning or mill construction; all additional basements or cellars shall be of fireproof construction as described in this Chapter, the elevator enclosures shall

be of brick from the lowest basement floor level to the first story floor, and the stairways shall be inclosed in fireproof partitions from the lowest basement floor level to the first story floor level with automatic closing standard iron doors, opening outwards.

(b) In cases where a pipe, conduit, dumb-waiter, cable, wire, conveyor or belt, or any combination thereof, passes through a floor from one basement to another, the opening in the floor shall be inclosed as specified in this Chapter.

(c) The number and width of stairs from the lowest basement floor to the first story shall be the same as required for the four highest stories of a building of the same area.

815. Concrete Floors in Basements—Requirements.) Wherever concrete floors are laid in basements of buildings now in existence or buildings hereafter to be erected, the concrete of such floors shall be at least three (3) inches in thickness and such floors shall be laid on a sand or cinder foundation not less than six (6) inches in thickness.

816. Canopy—Plans Must be Approved Before Permits Issue—Fee for Permit—No Advertising Matter or Obstructions Permitted.) It shall be unlawful for any person, firm or corporation to erect or construct any canopy attached to a building or structure under any general or special ordinance now in force or which shall or may hereafter be adopted without first submitting the plans of such canopy, and also of the part of the building or other structure to which it is to be attached, to the Commissioner of Buildings for his approval. No permit shall be issued by the Department of Public Works unless the plans of such canopy shall be approved by the Department of Buildings and a permit to attach said canopy to the building from which it is intended to project shall be obtained from the Commissioner of Buildings. The owner or agent shall pay to the Department of Buildings a fee of ten dollars for said building permit. No canopy that has been or may hereafter be authorized by any general or special ordinance, which projects over any street or other public place shall at any time be enclosed by canvas or other cloth or material in whole or in part so as to obstruct free passage underneath same, nor shall any such canopy be equipped with or have attached thereto any illuminated or other signs, transparencies, placards, streamers or other advertising devices of any kind; and in case any such canopy shall at any time contain such advertising matter or device it shall be the duty of the owner, lessee or person in charge or control of such canopy, upon notice from the Mayor, to forthwith remove such advertising matter or device.

817. Canopies and Marquees—Annual Inspection Fee.) The Commissioner of Buildings shall make an annual inspection of canopies and marquees attached to buildings or other structures which shall extend into or over any street, alley or any public place, and for such inspection shall make the following charge:

Where the horizontal projection of the canopy or marquee does not exceed 200 square feet in area the annual inspection fee shall be five dollars; and where the horizontal projection of the canopy or marquee exceeds 200 square feet in area the fee shall be five dollars for the first 200 square feet and one dollar additional for each additional 50 square feet in the area of such canopy or marquee.

818. Scaffolds—Protection During Building Operations—Temporary Floors.) (a) All scaffolds erected in this city for use in the erection, repair, alteration, or removal of buildings, shall be well and safely supported, and of sufficient width, and properly secured, so as to insure the safety of per-

sons working thereon or passing under or by the same; and to prevent the falling thereof, or the falling therefrom of any material that may be used, placed or deposited thereon.

(b) It shall be the duty of every owner, person or corporation who shall have the supervision or control of the construction of or remodeling of any building having more than three framed floors, whether some or all of such floors are above the established street grade, to provide and lay upon the upper side of the joists or girders, or both, of the first floor below the riveters and structural steel setters, a plank floor, which shall be laid to form a good and substantial temporary floor for the protection of the employees and all persons engaged above or below or on such temporary floor in such building.

(c) Provided, however, that where the permanent floor is in place on the floor herein required to be planked, a temporary protective floor shall not be required.

(d) A good and substantial temporary floor shall be laid on the joists or girders of the next lower floor where the temporary or permanent floor of the second story or the floor or floors above the second story or roof is being placed previous to the placing of the permanent floor or floors immediately below the floor which is being arched or planked. The lowest framed floor in a building shall be considered the first floor.

(e) In buildings more than three stories high where persons are working on a scaffold or scaffolds on the outside of such building such persons shall be protected by well secured planking, set over the heads of such persons for the full width of the scaffolding on which they are working if another story or other stories are being raised above such persons during the time they are working on such outside scaffold or scaffolding.

(f) It shall be the duty of all owners, contractors, builders or persons having the control or supervision of all buildings in course of erection which shall be more than thirty feet high, to see that all stairways, elevator openings, flues and all other openings in the floors shall be covered or properly protected, and it shall be their further duty to comply with an act of the Legislature of the State of Illinois, entitled "An act providing for the protection and safety of persons in or about the construction, repairing, alteration or removal of buildings, bridges, viaducts and other structures, and to provide for the enforcement thereof," approved June 3, 1907, and in force July 1, 1907.

(g) Any person, firm or corporation violating any of the provisions of this section shall be fined not less than one hundred dollars nor more than two hundred dollars for each offense, and any permit granted for the construction of such building may be revoked in the discretion of the Commissioner of Buildings where such violation occurs.

819. Wood Lathing and Plastering.) (a) In all buildings of frame or of ordinary construction, where the use of wood lath and plaster is permitted under the provisions of this chapter, such wood lath and plaster shall be done in accordance with the following specifications:

Wood lath shall not be over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than one-fourth of an inch apart. All wood lath must be covered with at least two coats of plaster; such lath and plaster to finish to a total thickness of at least seven-eighths of an inch; no dirty or loamy sand to be used in the mortar or plaster.

(b) In every building of frame or of ordinary construction which contains one or more rooms used for habitation or living purposes, the walls and ceilings of all rooms, including stores (except basement and attic rooms, not used for habitation or living purposes), throughout the building shall be covered with not less than two coats of plaster of the thickness and quality hereinbefore in this section prescribed. Provided, however, that where such building does not exceed one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in the room used for the purpose of Class I; and provided further, that where such building of frame or of ordinary construction and containing one or more living rooms is more than one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in such room used for the purpose of Class I according to the following provisions:

The ceiling of the room or rooms used for the purpose of Class I shall be plastered with at least one coat of plaster on wood lath; wood lath to be not over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than three-eighths of an inch apart. All wood lath to be covered with a heavy coat of mortar; such lath and plaster to finish to a total thickness of three-quarters of an inch in thickness. Before applying such metal ceilings, a wood strip not less than seven-eighths of an inch by one and one-quarter inch wide shall be used under every lap bead, or nailing flange at the intersection of all plates. Strips to be not more than two feet on centers in the direction of length of rooms with a cross strip every four feet on centers. A wire nail not less than three inches long shall be used in every strip at every joist in the surface to be covered. Metal plates to be not lighter than 29 gauge in thickness and nailed to every six inches on the lap.

(c) Where said metal-plates are applied on walls of buildings of frame or of ordinary construction containing one or more rooms used for habitation or living purposes, plastering upon walls must conform with the requirements of this section for plastered walls. A strip three-eighths of an inch in thickness may be used upon which to apply the metal, same to be nailed to every stud with a nail not less than two and three-quarter inches long; steel plates used on walls to be not lighter than 29 gauge and applied same manner as herein provided for ceilings.

(d) Wallboard or plasterboard of gypsum, asbestos, or other approved incombustible material, containing not more than four per cent (4%) by volume of paper or other combustible fabric reinforcement may be used as a substitute for wood lath where the use of wood lath is permitted by the provisions of this chapter in buildings of frame or of ordinary construction. When such wallboard or plasterboard is attached to metal studding or metal furring and is used as a base for two coats of plaster or mortar, the wallboard or plasterboard and plastering finishing to not less than seven-eighths of an inch in thickness in ceilings and in hollow partitions and not less than two inches in thickness in solid partitions. It may be used in this manner in such buildings and under such conditions as follows:

In buildings of slow burning and mill construction for partitions other than corridor partitions and other than enclosing partitions around stairways, elevators, shafts or other floor openings.

In buildings of fireproof construction of Class II, Class III and Class VI for suspended or false ceilings below a fireproof floor system or roof system built in accordance with the provisions of this chapter and for partitions other than corridor partitions and other than enclosing partitions around stairways, elevators, shafts or other floor openings. The ingredients and the proportions thereof for mortar and plaster and the manner of mixing and preparing same for plastering, as used in accordance with the requirements of this section, shall be subject to the approval of the Commissioner of Buildings.

821. Sidewalk—Delivery of Material—Elevated Sidewalks.) It shall be permitted for the purposes of delivering material to the basements of buildings in process of erection to erect elevated temporary sidewalks to a height of not exceeding four feet above the curb level of the street, and in case a sidewalk is so elevated it shall be provided with good, substantial steps or easy inclines on both ends of the same and shall have railings on both sides thereof.

822. Temporary Roof Over Sidewalk—Time Maintained.) When buildings are erected of a height greater than four stories

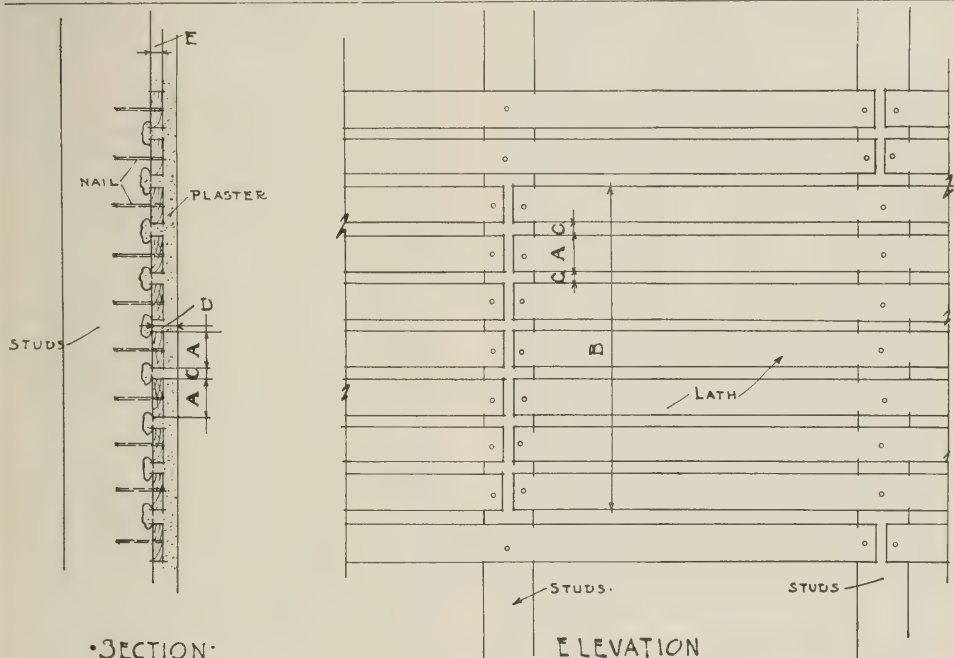


Fig. 39.

WOOD LATH AND PLASTERING.

Section 819.

- (A) Lath to be $1\frac{1}{2}$ " wide.
- (B) Break joints of lath every seventh lath.
- (C) Spacing of lath not to be less than $\frac{1}{4}$ " apart.

(Exception Class I— $\frac{3}{8}$ " spacing allowed—see Sec. 819b).

(D) Plaster coating to finish $\frac{3}{8}$ " thick.
(Exception Class I— $\frac{3}{4}$ " thick finish—see Sec. 819b).

820. Sidewalk and Street—Occupation of—Limitations.) (a) The extent of occupation of sidewalk and street to be covered by the terms of a permit for street obstruction or building, shall be as follows:

(b) Such permit shall not authorize the occupation of any sidewalk or street or part thereof other than that immediately in front of the lot or lots upon which any building is in process of erection and in relation to which such permit is issued.

(c) During the progress of building operations, a sidewalk not less than six feet in width shall be at all times kept open and unobstructed for the purpose of passage in front of such lot or lots. Such sidewalk shall, if there are excavations on either side of the same, be protected by substantial railings which shall be built and maintained thereon so long as excavations continue to exist. It is not intended hereby to prohibit the maintenance of a driveway for the delivery of material across such sidewalk from the curb line to the building site.

and such buildings are near the street line, there shall be built over the adjoining sidewalk a roof having a framework composed of supports and stringers of three by twelve timbers not more than four feet from center to center, covered by two layers of two-inch plank. When additional stories are added to an existing building and such building is located near the street line, there shall be built over the sidewalk, at the point where the new stories commence, a scaffold not less than six feet wide, which shall form a covering over the sidewalk composed of a framework of stringers and supports, covered by two layers of two-inch planks. Such framework and covering shall be of such construction and design as shall be satisfactory to the Commissioner of Buildings. Such roof shall be maintained as long as material is being used or handled on such street front above the level of the sidewalk. Temporary sidewalks, their railings, approaches and roofs over same, shall be made with regard to ease of approach,

strength, and safety, to the satisfaction of the Commissioner of Buildings.

823. Storage of Building Materials—Limitations.) The occupation of the street for the storage of building material for any one building or for temporary sidewalks, shall never exceed one-third of the width of the roadway of the same, and in no event shall any material be stored or placed within four feet of any steam or street railway track, and in all cases where such obstruction of the street is made there shall be a clear space of not less than one foot between such obstruction and the curb line. Provided, that the Commissioner of Buildings and the Commissioner of Public Works, or either of them, may limit, or entirely restrict, the storage of material on any street or alley where a tunnel, conduit, or any underground passageway or subway is located.

824. Sidewalks and Street—Excavated Material and Rubbish On—How Cared for.) Earth, other than sand to be used in the construction of the building, taken from excavations, and rubbish taken from buildings shall not be stored either upon the sidewalks or roadways of streets, and shall be removed therefrom from day to day as rapidly as produced. When dry rubbish is being handled, it shall be kept wetted down so as to prevent its being blown about by the wind.

825. Use of Derricks.) For all buildings more than four stories in height the use of derricks set upon the sidewalk or street is prohibited. In no case shall the guy lines be less than fifteen feet above the roadbed.

826. Frontage Adjacent—How Occupied for Building Purposes.) If the written consent of and a waiver of claims for damages against the city by the owners of properties adjoining the site of any proposed building is first obtained and filed with the Commissioner of Public Works, the permission to occupy the roadway and the sidewalk may be extended beyond the limits of such building in front of the property for which the consent of the owner or lessee thereof has been secured upon the same terms and conditions as those herein fixed for the occupation of sidewalk and street in front of the building site.

827. Street—Use of for Building Purposes—When Terminated—Red Lights.) (a) The permission to occupy streets and sidewalks for the purposes of building is intended only for use in connection with the actual erection, repair, alteration or removal of buildings, and shall terminate with the completion of such operation. It shall be unlawful to occupy any sidewalk or street after the completion of the operation for which a permit has been issued by the Department of Buildings. It shall also be unlawful to occupy a sidewalk or street, under authority of such permit, for the storage of articles not intended for immediate use in connection with the operations for which such permit has been issued.

(b) Red lanterns shall be displayed and maintained during the whole of every night at each end of every pile of material in any street or alley and at each end of every excavation.

828. Street Obstructions—Permits—Bonds—Fees.) (a) Permits for the obstruction of streets shall be issued by the Commissioner of Public Works and shall be paid in proportion to the street frontage occupied at the rate of five dollars per month for every twenty-five feet or fractional part thereof, of frontage so occupied, and before any permit shall be granted to any person, firm or corporation for the obstruction of any street or streets or sidewalk, an estimate of the cost of restoring said street and sidewalk to a condition equally as good as before it shall have been obstructed,

with a fair additional margin for contingent damages, shall be made by the Commissioner of Public Works. Such estimate in no case shall be less than two dollars per foot, or fractional part thereof, frontage of the portion of the street to be obstructed, and a deposit shall be required of the person, firm or corporation desiring to obstruct said street or sidewalk. Such deposit, less the charge of five dollars per month for each twenty-five feet of frontage used, shall be returned upon the restoration of the said street and sidewalk to a condition equally as good as before it was obstructed. When the Commissioner of Public Works shall receive satisfactory proof that said street and sidewalk have been restored to a condition equally as good as before it was obstructed, he shall issue a certificate to the Comptroller, certifying to said fact, and the comptroller shall thereupon forthwith issue a warrant on the City Treasurer for the amount of money thus deposited less the deduction herein provided for. But if the person, firm or corporation thus obstructing said street or sidewalk shall fail to restore the same to a condition equally as good as before it was obstructed within three days from and after the completion of the building or structure for which said deposit was required, then the city shall have the right to use such portion of said deposit as may be necessary to remove the obstructions and to restore the said street and sidewalk to a condition equally as good as it was before it was obstructed, and the amount thus expended shall be deducted from the amount of said deposit; provided, however, that nothing herein contained shall preclude the city from maintaining any action against the person, firm or corporation to recover for damage done to any street or sidewalk. No permit shall be issued until the applicant therefor shall have executed and filed with the Commissioner of Public Works a bond, with sureties to be approved by said Commissioner, and in an amount to be designated by him, in no case to be less than ten thousand dollars, conditioned to indemnify, save and keep harmless the city from any and all loss, cost, expense or liability of any kind whatsoever which it, the city, may suffer or be put to, or which may be recovered from it from or by reason of the issuance of such permit, or by reason of any act or thing done or neglected to be done under or by virtue of the authority given in such permit and the requirements of the city ordinances.

(b) Any permit issued pursuant to the terms of this section may be revoked by the Commissioner of Public Works at any time.

829. Building Operations at Night in Residential Districts Prohibited—Penalty.) It shall be unlawful for any person, firm or corporation, in conducting any building operations between the hours of ten o'clock in the evening and four o'clock in the morning to operate or use any pile drivers, steam shovels, pneumatic hammers, derricks, steam or electric hoists or other apparatus, the use of which is attended with loud or unusual noise in any block in which more than half of the buildings on either side of the street are used exclusively for residence purposes.

Any person, firm or corporation violating any of the provisions of this section shall be fined not less than five dollars, nor more than one hundred dollars for each offense, and each day's violations of same shall be considered a separate and distinct offense.

830. Stables and Barns—Regulations.) (a) It shall be unlawful for any person, firm or corporation to convert any building for the use of or to construct or maintain any stable or barn for the housing or keeping of more than two horses or other animals

on any lot abutting on a street or alley in which a public sewer is constructed without providing such stable or barn with an impervious floor properly drained to such sewer.

(b) It shall be unlawful for any person, firm or corporation to construct, locate, conduct or maintain any boarding, sales or private stable or barn for stabling or keeping of horses on the front two-thirds of any lot on any street where one-half of the buildings on both sides of the street between the next nearest intersecting streets are used exclusively for residence purposes without the written consent of a majority of the property owners according to frontage on both sides of the streets. Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction or alteration of any building or place for such purpose. Provided that in determining whether one-half of the buildings on both sides of the street are used exclusively for residence purposes any building fronting upon another street and located upon a corner lot shall not be considered.

(c) It shall hereafter be unlawful for any person, firm or corporation to locate, build, construct or maintain any building or structure for stabling or keeping of ten or more horses within a distance of four hundred feet from any school, church, hospital, public park or public playground.

(d) Any person, firm or corporation violating any of the provisions of this section shall be fined not less than twenty-five dollars (\$25.00) nor more than two hundred dollars (\$200.00) for each offense and each and every day on which such person firm or corporation shall conduct or maintain a stable or barn in violation of the provisions of this section, shall constitute a separate and distinct offense.

831. Tannery Not to Be Placed Within 600 Feet of Any Church, Public or Private School.) It shall be unlawful for any person, firm or corporation to build, construct, locate or maintain any building used, or to be used, for a tannery within six hundred feet of any building used for a church, hospital, public or private school, measured from the nearest point of the tannery to the nearest point of such church, hospital or school.

832. Gas Reservoir Not to Be Placed Within 500 Feet of any Public School.) It shall be unlawful for any person, firm or corporation to build, construct, locate or maintain any tank used or to be used for a gas reservoir within 500 feet of any public school. Said distance to be measured from the nearest point of the building or structure used for a gas reservoir to the nearest point of any building used for a public school.

ARTICLE XIV.

Fireproof Construction.

833. Fireproof Construction — Definition of.) The term "fireproof construction" shall apply to all buildings in which all parts that carry weights or resist strains and also all exterior walls and all interior walls and all interior partitions and all stairways and all elevator inclosures are made entirely of incombustible material, and in which all metallic structural members are protected against the effects of fire by coverings of a material which shall be entirely incombustible, and a slow heat conductor, and herein-after termed "fireproof material." Reinforced concrete as defined in this ordinance shall be considered fireproof construction, when built as required by Section 776.

834. Fireproof Material — Definition of.) The materials which shall be considered as filling the conditions of fireproof covering are: First, burnt brick; second, tiles of burnt clay; third, approved cement concrete; fourth, terra cotta.

835. Fireproof Construction—Tests For—Board of Examiners.) (a) In cases in which it is claimed that any equally good or more desirable mode or manner of construction, or material, or device for fireproofing, other than specified in this Chapter, can be used in the erection or alteration of buildings, the Commissioner of Buildings, upon written application to him for a permit to use the same, shall have power to appoint a Board of Examiners, consisting of not less than three nor more than five members, each of whom shall have at least ten years' experience as an architect, engineer or builder, who shall take the usual oath of office. Said oath of office shall be administered by the Commissioner of Buildings. The said examiners shall adopt rules and specifications for examining and testing such mode or manner of construction or material, or device for fireproofing, and furnish a copy of the same to the applicant. And such specifications shall provide that the material to be tested shall withstand successfully a fire of two hours' duration, rising to 1,700 degrees temperature, Fahrenheit, in the first thirty minutes and remaining at that temperature for the following ninety minutes. At the end of the two hours the material shall be quenched for at least five minutes with a stream of water from a one and one-eighth inch nozzle, at a nozzle pressure of fifty pounds per square inch. The said examiners shall notify such applicant to submit the proposed material for such examination and test; and such tests shall be made in the presence of the said examiners, or a majority thereof, according to such rules and specifications. All expenses of such examiners and such examinations and tests, shall be paid by the applicant, and said examiners may require security therefore.

(b) The said examiners shall within 30 days after such examination and tests, certify the results of such test, and their decision on the said application to the Commissioner of Buildings, who shall in the event of the examination and tests being satisfactory, authorize the use of such material or construction as fireproof material.

(c) A complete record of the proceedings and all acts and decisions of the said Board of Examiners shall be kept by the Commissioner of Buildings in his office.

(d) The Commissioner of Buildings shall have the power to pass upon any question relative to the mode or manner of construction or materials to be used for fireproofing in the erection or alteration of any building or structure to make the same conform to the true intent and meaning of the several provisions of this Chapter.

836. Incombustible Material.) The following materials shall be considered as incombustible material: A metal or fire-resisting glass not less than one-quarter of an inch in thickness, metal, plastering on metal lath and metal-studding, plaster blocks, stone, granite, marble, approved cinder concrete, or one of the fireproof materials described in this chapter.

837. Walls — Enclosing in Buildings of Steel Skeleton Construction.) If buildings are made of fireproof construction, and have skeleton construction so designed that their enclosing walls do not carry the weight of floors or roof, then their walls shall not be less than twelve inches in thickness; provided, such walls shall be thoroughly anchored to the iron skeleton, and whenever the weight of such walls rests upon beams or columns, such beams or columns shall be made strong enough in each story to carry the weight of wall resting upon them without reliance upon the walls below them. All walls shall be of fireproof or incombustible material.

838. **Columns—Exterior protection.** (a) All iron or steel used as vertical supporting member of the external construction of any building exceeding fifty feet in height shall be protected against the effects of external change of temperature, and of fire by a covering of fireproof material consisting of at least four inches of brick, hollow terra cotta concrete, burnt clay tiles, or of a combination of any two of these materials, provided that their combined thickness is not less than four inches. The distance of the extreme projection of the metal, where

such metal projects beyond the face of the column, shall be not less than two inches from the face of the fireproofing; provided, that the inner side of exterior columns shall be fireproofed as hereafter required for interior columns.

(b) Where stone or other incombustible material not of the type defined in this ordinance as fireproof material is used for the exterior facing of a building, the distance between the back of the facing and extreme projection of the metal of the column proper shall be at least two inches,

Fig. 40.

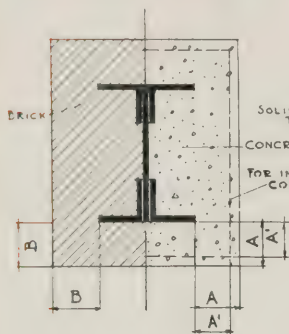


Fig. 41.

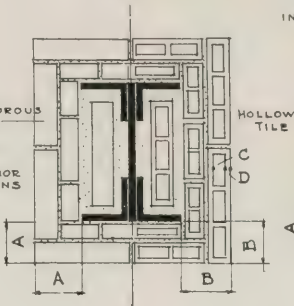


Fig. 42.

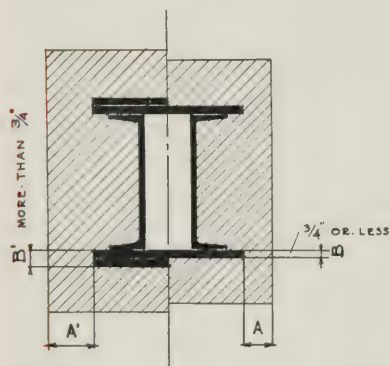
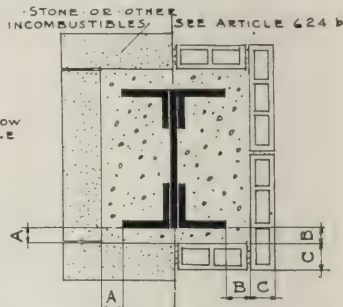


Fig. 43.

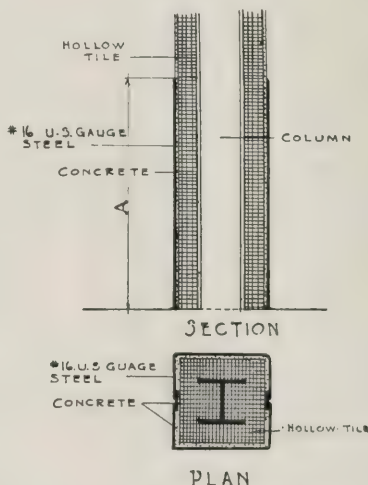


Fig. 44.

PROTECTION OF EXTERIOR COLUMNS.

Section 838.

Figs. 40, 41, 42. Requirement for protection of columns of building exceeding 50 ft. height from external change of temperature and fire.

- Fig. 40. (A) 4" concrete required.
- (B) 4" brick required.
- Fig. 41. (A) 4" solid porous tile required.
- (B) 4" hollow tile required.

PROTECTION OF INTERIOR COLUMNS.

Section 839.—Requirements for Interior Columns.

Fig. 40. (A') Concrete 3" (shown dotted).

(B) Brick 4".

Fig. 41. (A) Solid porous tile, two layers of 2" each tile.

(B) Hollow tile, 2 layers of 2" each.

For hollow tile (C) is to equal 1½" air space, and (D) not less than ¾".

Fig. 42. (B plus C). Each equal ½" thickness required, if used singly, provided if concrete (B) is used it shall not be less than 2".

Fig. 42. (A) If stone or other incombustible material is used for exterior facing then (A) can equal 2".

(B) (C) Combination of materials in fire-proofing, etc., is allowed as at (B plus C), providing their combined thickness is not less than 4 inches.

Section 839c.

Fig. 43. In case of H shaped cross section of columns, etc., fire-proof covering may be reduced to 2½" (A) providing (B) flange projection is ¾" or less.

If (B) is more than ¾" as at (B') then A must be as before specified for interior columns as at (A').

Section 840b.

Fig. 44. Drawing showing protective casing for lower part columns. (A) = 6' 6".

and the intervening space shall be filled with one of the fireproof materials.

(c) In all cases, the brick, burnt clay, tile or terra cotta, if used as a fireproof covering, shall be bedded in cement mortar close up to the iron or steel members, and all joints shall be made full and solid.

(Exterior and Interior Illustrations on the next page.)

839. Columns—Interior.) (a) Covering of interior columns shall consist of one or more of the fireproof materials herein described.

(b) If such covering is of brick it shall be not less than four inches thick; if of concrete, not less than three inches thick; if of burnt clay tile, such covering shall be in two consecutive layers, each not less than two inches thick, each having one air space of not less than one-half inch, and in no such burnt clay tile shall the burnt clay be less than five-eighths of an inch thick; or if of porous clay solid tiles, it shall consist of at least two consecutive layers, each not less than two inches thick; or if constituted of a combination of any two of these materials, one-half of the total thickness required for each of the materials shall be applied, provided that if concrete is used for such layer it shall not be less than two inches thick.

(c) In the case of columns having an "H" shaped cross section or of columns having any other cross section with channels or chases open from base plates to cap plates on one or more sides of the columns, then the thickness of the fireproof covering may be reduced to two and one-half inches, measuring in the direction in which the flange or flanges project, and provided that the thin edge in the projecting flange or arms of the cross sections does not exceed three-quarters of an inch in thickness. The thickness of the fireproof covering on all surfaces measuring more than three-quarters of an inch wide and measuring in a direction perpendicular to such surfaces shall be not less than that specified for interior columns in the beginning of this section, and all spaces, including channels or chases between the fireproof covering and the metal of the columns, shall be filled solid with fireproof material. Lattice or other open columns shall be completely filled with approved cement concrete.

840. Columns—Wiring Clay Tile On.)

(a) Burnt clay tile column covering shall be secured by winding wire around the columns after the tile has all been set around such columns. The wire shall be securely wound around tile in such manner that every tile is crossed at least once by a wire. If iron or steel wire is used it shall be galvanized and no wire used shall be less than number twelve gauge.

(b) In places where there is trucking or wheeling, or handling of packages of any kind, the lower five feet of every column incased with hollow tile shall be incased in a protective covering of No. 16 U. S. gauge steel embedded in concrete.

841. Concrete—Approved Cement—When Fireproof.) (a) All approved cement concrete shall consist of a standard Portland cement, torpedo sand, and crushed stone or gravel, or crushed blast furnace slag, or crushed burnt clay, the volumetric quantity of all materials except the Portland cement shall not exceed eight times the volume of the Portland cement. All of the ingredients of cement concrete shall be thoroughly worked and wet so as to cover each piece of stone or gravel or slag or burnt clay with moistened cement; and the cement and sand shall fill the voids between the coarse material of the cement concrete.

(b) Cement concrete to be considered a fireproof material shall comply with the provisions of Section 776 and shall be cast and worked in an unset condition against the metal. In all cases where cinder concrete is used, the metal shall be protected as required by Section 780 of this Chapter.

842. Concrete Ingredients.) (a) The separate ingredients of concrete shall be measured for each batch, and shall be thoroughly mixed and must be uniform in color, appearance and consistency before placing. The concrete shall be worked continuously with suitable tools, as it is put in place, filling the forms completely.

(b) The sand to be used for concrete shall be clean coarse sand, free from loam or dirt. If crushed stone grit is used it shall be clean, gritty, and free from dust.

(c) The stone to be used in concrete shall be clean crushed hard stone, or clean crushed blast furnace slag, or gravel, and of a size to pass through a 1½-inch square mesh. If limestone or slag is used, it shall be screened to remove all dust; if gravel is used, it shall be thoroughly washed. Stone shall be drenched immediately before using.

(d) In all cases, the brick or hollow tile, solid tile, or terra cotta shall be bedded in cement mortar close up to the iron or steel member and all joints shall be made full and solid.

843. Pipes Enclosed by Covering.) (a) Pipes shall not be enclosed in the fireproofing of columns or in the fireproofing of other structural members of any fireproof building; provided, however, gas or electric light conduits not exceeding one inch diameter may be inserted in the outer three-fourths inch of the fireproofing of such structural member, where such fireproofing is entirely composed of concrete.

(b) Pipes or conduits may rest upon the tops of the steel floor beams or girders, provided they are imbedded in cinder concrete to which slaked lime equal to five per cent of the volume of concrete has been added before mixing or their being imbedded in stone concrete.

844. Shafts—Doors—Frames—Enclosure.)

(a) In cases where a pipe, conduit, dumb waiter, cable wire, conveyor, belt, or any combination thereof, passes from one story to another story through an open hatch or floor opening, a shaft or enclosure of fireproof material shall be built from floor to floor around such hatch or floor opening in each story above and below such hatch or floor opening in the same manner as described for fireproof partitions in this chapter, and no wood shall be used in the construction, support or fittings of such shaft. The area of space thus enclosed shall not exceed the area of the floor opening by more than one hundred per cent.

(b) All burnt clay or terra cotta partitions or walls around such shafts shall be plastered on the outside and plastered or pointed on the inside.

(c) All doors, frames, sashes, casings and windows in partitions or walls around such floor openings, shall be built of incombustible material. The supports of such doors, frames, sashes, casings and windows shall also be of incombustible material. In the case of doors, such supports shall be of rolled structural metal extending from floor to ceiling and secured to both. Where there are brick walls of twelve inches or more in thickness, the supports need not extend to ceiling as above specified. All glass used in connection with such partitions or walls shall be wired glass.

(d) Such fireproof enclosures may be omitted if all of the space in each floor opening not occupied by pipes, conduits, cables, wires, or any combination thereof, are filled in solid fireproof material not less than eight inches thick.

845. **Spandrel Beams, Girders, Lintel.)** The metal of the exterior side of the spandrel beams or spandrel girders of exterior walls, or lintels of exterior walls, which support a part of exterior walls, shall be covered in the same manner, and with the same material as specified for the exterior columns in this chapter; provided, however, that shelf angles connected to girders by brackets or projections of girder flanges not figured as part of the flange section, may come within two inches of the face of the brick or other covering of such spandrel beams, girders or lintels. The covering thickness shall be measured from the extreme projection of the metal in every case.

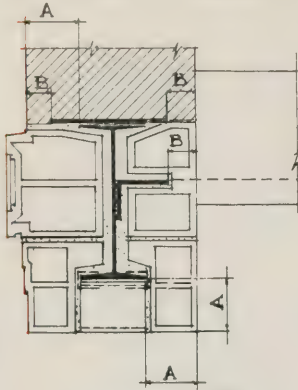


Fig. 45.

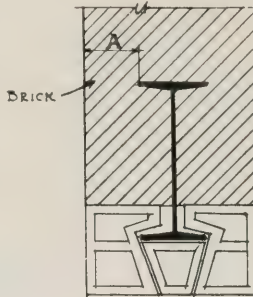


Fig. 46.

PROTECTION OF BEAMS.

Section 845, 846.

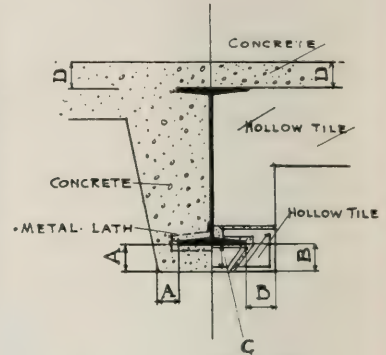


Fig. 47.

(A) Fire-proof covering for beams, girders, etc., for exterior structural parts, Sec. 845. See provisions for columns (Sec. 838) for A.

Fig. 45. (B) Allowable covering for shelf angles, etc., not figured part of flange section to be 2".

Figs. 45, 46, 47. Necessary fire-proof covering for beams, girders, etc., for interior structural parts (Sec. 618).

Fig. 46. (A) 4" for brick (Sec. 846b).

Fig. 47. (B) 2" for hollow tile or solid tile (Sec. 618b).

(A) 2" for concrete (Sec. 846b).

(C) $\frac{3}{4}$ " air space by width of metal surface to be covered as required (Sec. 846b).

(D) Concrete covering for tops of beams, girders, etc., to be 2" (Sec. 846c).

846. **Beams, Girders and Trusses—Coverings of.)** (a) The metal beams, girders and trusses of the interior structural parts of a building shall be covered by one of the fireproof materials hereinbefore specified so applied as to be supported entirely by the beam or girder protected, and shall be held in place by the support of the flanges of such beams or girders and by the cement mortar used in setting.

(b) If the covering is of brick, it shall be not less than four inches thick; if of

(d) in all cases of beams, girders or trusses, in roofs or floors, the protection of the bottom flanges of the beams and girders and so much of the web of the same as is not covered by the arches shall be made as hereinbefore specified for the covering of beams and girders. In every case the thickness of the covering shall be measured from the extreme projection of the metal, and the entire space or spaces between the covering and the metal shall be filled solid with one of the fireproof materials, excepting the air spaces in hollow tile.

(e) Provided, however, that all girders or trusses when supporting loads from more than one story shall be fireproofed with two thicknesses of fireproof material or a combination of two fireproof materials as required for interior columns in Section 839 of this chapter, and each covering of fireproof material shall be bedded solid in cement mortar.

(f) The fireproofing herein required for metal structural roof members may be omitted in buildings used exclusively for purposes of Class IV and of Class V, when such structural roof members support only roof loads and ceiling construction over interior open spaces under the following conditions. A continuous ceiling of incombustible material shall be suspended below the roof from the structural roof members. There shall be no openings in ceilings other than those required for ventilation. Where the plane of the ceiling is twenty feet or more above the floor of the open space, all structural mem-

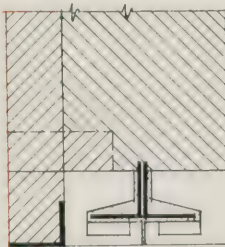


Fig. 48.

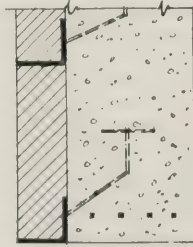


Fig. 49.

Where lintels are fireproofed previously and independently, the Commissioner of Buildings has ruled that the application of the architectural facing may be supported as shown (Fig. 48, 49).

The ruling is only applied to openings not to exceed four feet in width, and the maximum depth of the beam is not to exceed eighteen inches.

bers or parts thereof projecting below said ceiling shall be fireproofed as required by the provisions of this Chapter. The fireproofing to extend upward two inches above the ceiling level. Where the plane of the ceiling is nearer than twenty feet to the floor of the open space all structural members above or below such ceiling to the height of twenty feet above the highest point of the floor of the open space shall be fireproofed as required by the provisions of this Chapter. Openings in ceilings for ventilation shall be connected by a conduit or duct to the outside of the building. Ducts shall be of metal or other incombustible material and if of metal where such ducts have an area greater than 400 square inches same shall be constructed double with an intervening air space.

847. Fireproofing of Exterior Sides of Mullions.) In buildings required by this chapter to be of fireproof construction or exposures where metal frames, doors, sash and wired glass are not required, all vertical door or window mullions over eight inches wide shall be faced with incombustible material, and horizontal transom bars over six inches wide shall be faced with a fireproof or with an incombustible material.

848. Fireproof Covering, Independent.) The fireproof covering of brick, concrete, burnt clay tiles, hollow terra cotta or of a combination of any two of these materials shall be applied to all of the structural members of the exterior of a fireproof building previous to and independent of the application of the architectural facing of such fireproof building with an incombustible or fireproof material.

849. Walls, Support and Fireproofing of.) Where skeleton construction is used for the whole or part of a building the enveloping material and the walls shall be independently supported on the skeleton frame for each individual story.

850. Iron or Steel Plates for Support of Wall.) Where iron or steel plates or angles are used in each story for the support of the facings of the walls of such story, such plates or angles shall be of sufficient strength to carry the weight within the limits of fibre stress for iron and steel elsewhere specified in this chapter of the enveloping material for such story, and such plates or angles may extend to within two inches of the exterior of such covering.

851. Cut-out Boxes, Chases, Etc.—Fireproof Covering.) No electric service cut-out box, switch box, cabinet, chase or any other recess, shall encroach on the minimum thickness required for any fireproof covering on structural metal, except as provided in this chapter. If the depth of any cut-out box, switch box, cabinet, or chase, or if any other recess is to be concealed, or partially concealed, then the thickness of the fireproof covering shall be increased correspondingly.

852. Segmental and Flat Arches.) (a) Segmental arches shall have a rise of at least one inch for each foot of span of arch.

(b) The least thickness of a hollow tile or porous terra cotta segmental arch shall be one-half of an inch per foot of span, but no such hollow tile or terra cotta arch shall be of a thickness less than five inches.

(c) Both flat and segmental arches shall be so constructed that the joints of the same radiate from a common center and there shall be a cross rib for every four inches, or fractional part thereof, in height in each tile block. The skewback of the arches shall be carefully fitted to the beams supporting them, and, in addition to the cross ribs, there shall be additional diagonal re-enforcing ribs in the skewback. Such arches, whether flat or curved, shall have their beds well filled with cement mortar, and the

centers shall not be struck until the mortar has set.

(d) Burnt clay skewbacks shall be molded in such a manner as to support the burnt clay covering on the under sides of beams or girders.

853. Fireproof Floor and Roof Construction.) Brick, hollow tile, porous terra cotta, or approved cement concrete, or approved cinder concrete, shall be used for the construction of floor and roofs of fireproof buildings. Flat arch hollow tile, or flat arch porous clay tile floor arches shall have a height of at least one and one-half inches for each foot of span.

854. Wood Flooring and Nailing Strips.) (a) Wood flooring and wooden nailing strips for such flooring may be used in fireproof buildings.

(b) Where such flooring is used in a fireproof building, the space immediately under the flooring, and between the nailing strips and under such nailing strips, shall be filled with a cement or a cinder concrete tamped into place in an unset state, or with such other incombustible material as shall be approved by the Commissioner of Buildings.

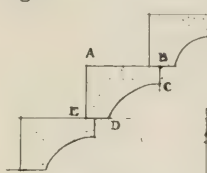


Fig. 50.

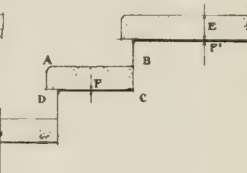


Fig. 51.

Section 854c.

Fig. 50. Area of cross section A B C D E shall not be less than 60 sq. inches.

Section 854d.

Fig. 51. If area of cross section (A B C D) is less than 60 sq. inches or (E) (thickness of platform) less than 7 in., then metal sub-tread F and sub-platform F' ($= 3/32$ in. thickness) is required.

Section 854e gives exception to above.

855. Partitions in Fireproof Buildings.)

(a) Where stairs, shafts and elevators are enclosed they shall be enclosed in fireproof partitions, as described in Section 856 of this chapter; all other partitions, shall be incombustible partitions. Where blocks are used for building partitions, the joints shall be well filled with mortar.

(b) The partitions shall be wedged tight between floor and ceilings with incombustible wedges.

856. Partitions — Fireproof — Incombustible.)

(a) Only fireproof material shall be used for fireproof partitions; if of brick, they shall be not less than four inches thick, and if of partition blocks, not less than three inches thick. If fireproof partitions are of reinforced concrete they shall be not less than three inches thick.

(b) All fireproof partitions required by this ordinance shall be supported directly on the steel construction, or on the fireproof floor arches, or on concrete, or on brick.

(c) Only fireproof or incombustible material shall be used in the construction of partitions not required to be fireproof, excepting that frames, casings, doors, sash and the rough carpenter work required for the proper fastenings of such frames, casings, doors or sash, may be of wood, and that ordinary glass may be used in doors and partition windows.

(d) All corridor partitions of incombustible or fireproof material in fireproof buildings, shall be supported directly on the steel construction, on the fireproof floor arches, on concrete or on brick.

857. Stairs—Landings.) (a) Stairs in fireproof buildings shall be built of approved cement concrete, reinforced concrete, stone or metal, or a combination of one or more of such materials.

(b) The handrails of such stairways may be of wood.

(c) If stairs are constructed of solid stone or plain concrete, having the tread and riser in one piece, then there shall be not less than sixty square inches of stone or concrete in the cross section of such combined tread and riser.

(d) If stone treads have less than sixty inches of cross section and platforms less than seven inches in thickness are used, they shall have a metal sub-tread and sub-platform three thirty-seconds of an inch thick.

(e) If platforms have a floor arch sub-construction as described in Section 852 and 853 of this chapter, then the metal sub-platform may be omitted.

858. Roofs—Rise of Roof Above Limit of Height.) In the case of buildings which are fireproof in their construction, the roof may rise above the limit of height of wall fixed by this chapter for such buildings at a slope not to exceed thirty degrees with the horizon, and to a height not exceeding twenty feet above such limitation of the height of the wall. The space enclosed by such roof above the limitation of the height of such wall may be used as an inclosure for pipes, ventilating or elevator machinery or for ventilating ducts, but it shall not be lawful to use such space for purposes of storage, business or residence.

859. Sheet Metal Work—Support Of.) Wood shall not be used as the support of any sheet metal work or of any gutter or cornice of a building more than fifty feet in height.

ARTICLE XV.

Slow Burning Construction.

860. Slow-Burning Construction Defined.) The term "Slow-Burning Construction" shall apply to all buildings in which the structural members, other than walls elsewhere required to be of masonry, which carry the loads and strains which come upon the floor and roofs thereof are made wholly or in part of combustible material, but throughout which the structural metallic members, if used, are fireproofed as required for fireproof construction. Where metallic lintels are used to cover wall openings the fireproofing on the underside may be omitted where such lintels are fireproofed on the other three sides and all voids in them are filled solid with fireproof material. The lower five feet of metal columns shall be protected as required in Section 848 of this Chapter. Underside of joists shall be protected by a covering of three coats of plaster laid on metal lath; and a layer of mortar or other incombustible material at least one and one-half inches thick shall be applied on all floors and roof surfaces above the joists of same.

The fireproofing herein required for metal structural roof members may be omitted in any building of slow-burning construction used exclusively for purposes of Class IV of seating capacity less than one thousand persons or in any building of slow-burning construction used for purposes of Class IV in combination with any other class where such part of such building as is used for purposes of Class IV has a seating capacity of less than one thousand persons and is separated from all other parts of such building by brick walls of thickness required in this Chapter and also by floors of fireproof construction, when such structural roof members support only roof loads and ceiling construction over interior open spaces under the following conditions. A continuous ceiling of incombustible material shall be suspended below the roof from the

structural roof members. There shall be no openings in ceiling other than those required for ventilation. Where the plane of the ceiling is thirty feet or more above the floor of the open space all structural members or parts thereof projecting below said ceiling shall be fireproofed as required by the provisions of this Chapter, the fireproofing to extend upward two inches above the ceiling level. Where the plane of the ceiling is nearer than thirty feet to the floor of the open space all structural members above or below such ceiling to the height of thirty feet above the highest point of the floor of the open space shall be fireproofed as required by the provisions of this Chapter. Openings in ceiling for ventilation shall be connected by a conduit or duct to the outside of the buildings. Ducts shall be of metal or other incombustible material, and if of metal where such ducts have an area greater than 400 square inches same shall be constructed double with an intervening air space. The floor levels of balconies and galleries having a gross area of less than fifteen per cent (15%) of the gross area of the floor of such open space shall not be used as a basis for calculating the height of such fireproofing.

861. Posts, Girders and Partitions.) Wood posts, if used, shall be of not less than one hundred square inches sectional area. Wood girders, if used, shall be of not less than seventy-two square inches sectional area. All partitions in buildings of this type shall be made entirely of incombustible material. Wood furring, wood studs and wood lath shall not be permitted in buildings of this type.

862. Stair, Construction of.) Where buildings are required to be of "slow burning" construction, all stairs in such building shall be of incombustible material, except as hereinafter provided. Said stairs may be of ordinary construction, if said building is equipped with an automatic sprinkler system, and stairs are enclosed in a fireproof wall.

ARTICLE XVI.

Mill Construction.

863. Definition—Mill Construction Requirements.) The term, "Mill Construction" shall apply to all buildings in which wooden posts, if used, have a sectional area of not less than one hundred square inches, and wooden girders and joists a sectional area of not less than seventy-two square inches, and roofs, if of wood, a thickness of not less than two and five-eighths inches in a single layer, except where the building is equipped throughout with a sprinkler system, subject to the approval of the Chief Fire Prevention Engineer, in which event such layer may be not less than one and five-eighths inches thick, and floors, if of wood, a thickness of not less than three and one-half inches in not more than two layers, the lower one of which shall be not less than two and five-eighths inches in thickness, and in which all structural metallic members, if used, are fireproofed as required for fireproof construction. Where metallic lintels are used to cover wall openings the fireproofing on the underside may be omitted in case such lintels are fireproofed on the other three sides and all voids in them are filled solid with fireproof material. All floors and roofs not constructed as above shall be of fireproof construction as elsewhere required for fireproof construction in this chapter.

864. Fireproofing.) (a) Partitions in buildings of mill construction shall be made entirely of incombustible material. If iron columns, girders, or beams are used in buildings of this type they shall be protected as specified in this Chapter; but the wooden posts, girders and joists need not be protected by fireproof covering. Wood

furring, wood studs and wood lath shall not be permitted in buildings of this type.

(b) If reinforced cinder concrete construction is used in the structural parts of a building which is required to be of slow-burning or mill construction by this chapter, then all partitions shall be of incombustible material and all parts other than structural parts and partitions of the building shall be as required for slow-burning or mill construction buildings by this chapter.

865. Stair Construction Where Automatic Sprinkler System is Installed.) In buildings required to be of "mill construction," all stairs in such buildings shall be of "incombustible" material, except as hereinafter provided. Said stairs may be of wood construction if said building is equipped with an automatic sprinkler system and stairs are enclosed in a fireproof wall.

ARTICLE XVII.

Ordinary Construction.

866. Ordinary Construction Defined.) The term "ordinary construction" as used in this chapter, means the ordinary system of construction in which timber and iron structural parts are not protected with fire-resisting coverings and in which the walls are of masonry built as required by this chapter.

ARTICLE XVIII.

Frame Buildings.

867. Repairing of Frame Buildings Within Fire Limits.) Frame buildings within the fire limits which have been damaged by fire, decay or otherwise, to an extent not greater than fifty per cent of their value may be repaired, provided there is no increase in size of such buildings over their original dimensions, and, provided that incombustible roof covering required by Section 811 is used. And, provided, further, that where any frame building is raised for the purpose of erecting a basement story under the same, the walls enclosing such basement shall be of masonry.

868. Frame Buildings Prohibited—Exceptions.) (a) Hereafter no frame building shall be erected, nor any frame addition made to an existing frame building within the fire limits of the city, except where express provision is made in this chapter therefor.

(b) Outside the fire limits it shall be lawful to erect frame buildings not exceeding forty feet in height from the sidewalk to the highest point of roof. If such frame buildings have a basement story of masonry, their height above the sidewalk may be made not to exceed forty-five feet. Provided, however, that in no case shall any portion of any frame building above the second floor be used as a separate living apartment.

(c) It shall be lawful to surround frame buildings with a veneer of brick not less than four inches in thickness, provided the said brick is not carried higher than the second story, or twenty-two feet above the basement ceiling; and provided further that the said veneer is anchored to the studding or other frame construction in a manner satisfactory to the Commissioner of Buildings. Such brick veneer is not to be placed on gables or any other parts of frame buildings above the height herein specified. All frame buildings which it is desired to surround with brick veneer must have their basement walls and foundations of solid masonry, as provided in Section 872.

869. Frame Buildings Within the Fire Limits Changed Into Flat Buildings—Fire Walls.) Whenever any frame building within the fire limits shall be remodeled, altered or charged for the purpose of using the same for flats or apartments, or whenever such frame building shall be occupied for

flat or apartment purposes, each suite of apartments in such building shall be separated from every other suite of apartments in such building by a wall of incombustible material, of such dimensions and thickness as required by this chapter.

870. Frame Buildings—Raising—Requirements—Changing Gable or Hip Roofs to Flat Roofs.) Permission may be granted by the Commissioner of Buildings for the raising of existing frame buildings, whether within or without the fire limits, to the limits of height hereinbefore fixed for new frame buildings, and no more, and inside the fire limits for the purpose of putting a masonry basement thereunder. The Commissioner of Buildings is also authorized to issue permits for changing gable or hip roofs of existing frame buildings to flat roofs, and for the raising of walls incident to such change. But if such hip or gable roof is changed to a flat roof and the walls raised in connection with such change, the total cubic contents included by the walls so raised and the roofs so altered shall not exceed the cubic contents originally included in such gable or hip roof, and in no case shall a two-story and attic building be converted into a three-story building thereby.

871. Frame Buildings Carried to a Uniform Height.) Where the different parts of a frame building inside the fire limits are of different heights a one-story portion may be raised to the height of two stories, provided the greatest height thereof does not exceed the limits of height prescribed in this chapter for frame buildings and provided, that no room in the existing building or in the addition thereto shall violate the requirements of this chapter for habitable rooms.

872. Basement or Story Placed Beneath Frame Buildings.) A frame building may be raised for the purpose of erecting a basement or story, or both, thereunder, but the principal floor of such frame building shall not be raised to a higher level than 16 feet above the grade of the sidewalk upon which such premises abut. Where a building so raised is one story in height only and the same is raised so as to permit a basement under the same not to exceed six feet six inches in height from the basement floor to the ceiling of said basement, the said house may be placed upon cedar posts. In all other cases the walls enclosing such basement or story shall be of masonry and not less than 12 inches thick except where a one-story frame building is raised and has a basement only built thereunder, the masonry walls of such basement may be eight inches thick above grade and 12 inches thick below. The foundation of such wall shall be constructed as provided in this chapter; provided, however, that no frame building shall be raised for the purpose of constructing a basement or story, or both, under the same to a greater height to the top of its roof than that elsewhere herein given as the maximum height above grade for frame buildings. The thickness of walls hereinbefore required shall also apply to brick walls in new frame buildings.

873. Chimneys in Frame Buildings—Chimney Flues Through Partitions.) Chimneys in frame buildings shall be built as required by Section 800 of this chapter. The wood framing of frame buildings shall be trimmed around chimneys in such a manner as not to come within two inches of same.

874. Lot Lines—Requirements as to Number—Dimensions.) Frame buildings, excepting sheds not exceeding three hundred square feet in area and not exceeding fourteen ft. in height from the ground, shall not be built nearer than one foot to any line of the lot upon which they are built, street and alley lines excepted, except as hereinafter

provided. It shall not be lawful to erect a frame building wider than forty feet nor deeper than seventy feet, unless such building be divided by a fire wall or fire walls, built of incombustible material and of a thickness of not less than four inches and of construction to be approved by the Commissioner of Buildings, so that no more than two thousand eight hundred square feet of superficial area shall be contained in any section or part of such building, uninclosed by such fire walls, and if openings are inserted in such fire walls, then such walls shall be built of brick not less than eight inches thick, and such openings shall have doors as described in Section 789. Each section of such buildings shall be regarded as a separate building for the purpose of determining the number and construction of its stairways and means of egress. If more than one frame building is built in the direction of the depth of any one lot, such buildings shall not be built with a less distance than ten feet between them except where both buildings are used for living purposes, and in that case the distance shall be governed by Sections 641 and 642 of this chapter.

Note: See also Sec. 488 (b) as to distance between lot and building lines (Class III).

875. Sheds—Open Shelter—Height of Walls and Foundations—Enclosed. (a) Except as hereinafter provided, open shelter sheds not exceeding eight hundred square feet in area may be erected within the fire limits, provided they have roofing of incombustible material and the highest point is not over fifteen feet above the ground, and provided that the roofs be supported on sufficient posts or piers; provided further, however, that such sheds may be built with an area not to exceed sixteen hundred square feet, if they are kept at least twenty-five feet from any lot line and any other building or structure. Such sheds shall have no combustible enclosing walls or wooden floors, except that a floor of two-inch plank laid directly upon the ground may be used. Such sheds shall only be erected upon the rear of the lot, and not more than one such shelter shed or any other shed shall be erected on any lot of twenty-five feet in width.

(b) If it is desired to enclose an open shelter shed, the enclosing walls shall be made of brick, hollow tile, or other incombustible material, and such walls shall have foundations extending to solid ground and at least four feet below the surface of the ground.

(c) Open shelter sheds may be erected outside the fire limits not to exceed twenty-eight hundred square feet in area and subject to the approval of the Commissioner of Buildings; provided, however, that shelter sheds which comply in other respects with the requirements of this section, may be built not to exceed nine thousand square feet in area where such sheds are located at least twenty feet distant from any other structure and from any lot line.

(d) It shall be lawful to erect inclosed wooden shelter sheds at any fire department station in the city for the storage of fuel and supply wagons. Such sheds shall not exceed twenty-five feet in width, thirty feet in length and fourteen feet in height.

(e) Sheds not exceeding fourteen feet in height from the ground to the highest point thereof, and not exceeding three hundred square feet in area, with an incombustible roof, may be constructed of wood within the fire limits. Such sheds shall not be located on the front part of any lot, nor shall they be used as a dwelling or as an addition to a dwelling house, or for any business purpose whatever, nor shall more than one shed be erected on any one building lot of twenty-five feet in width.

(f) Frame auto-sheds housing not to exceed two automobiles or auto cars may be erected inside the fire limits of area not to exceed 400 square feet. Such auto-sheds shall have an incombustible roof and shall have a concrete floor not less than 4 inches thick laid directly upon the ground. At the time of applying for a permit for such auto-shed, applicant shall submit a plat of the lot showing the location of same made by a licensed surveyor and giving the established grade of the alley upon which such auto-shed shall open. Such shed shall not exceed 14 feet in height and shall be situated on the rear of the lot; shall be used for the purpose of housing automobiles only and there shall not be more than one such shed on any lot or premises.

876. Sheds—Coal, Brick, Stone, Cement and Salt Sheds and Sheds for Icing Cars Along Railroad Tracks and Navigable Stream Frontage Consents.) Open shelter sheds to be used for the storage or handling of coal, brick, stone, cement, salt or such commodities which are incombustible, or for the icing of cars, may be erected within or without the fire limits upon, along or adjacent to steam railroad tracks, or along or adjacent to navigable waters; provided, such sheds shall have incombustible roofing and shall not exceed 35 feet in height from the ground to the highest point of the roof; provided, further, that said sheds shall be located at least 25 feet distant from any other structure and from any side lot line. If it is desired or intended to enclose any such sheds, the enclosing walls shall be of incombustible material. No such shed shall be built upon any lot or parcel of ground fronting upon any street within 200 feet of any building used exclusively for residence purposes, unless the consent of the owners of the majority of the frontage on both sides of such street between the two nearest intersecting cross streets shall first have been obtained by the person, firm or corporation desiring to erect and maintain such shed, and said written consents shall be filed with the Commissioner of Buildings before a permit shall be issued for such shed.

877. Ice Houses.) (a) Houses within the fire limits to be used exclusively for the storage of ice, not exceeding forty-five feet in height, and of a floor area not exceeding 9,000 square feet, may be constructed of wood with incombustible roofing, the walls to be enclosed with an envelope of incombustible material; eight-inch walls of brick or tile or approved cement concrete with proper foundations of masonry shall be used for such envelopes.

(b) Houses to be used exclusively for the storage of ice, located outside of the fire limits and contiguous to any lake and six hundred feet from any other building, except buildings used in connection with the conduct of said business, may be constructed of frame with incombustible roofing, and the floor area of any such building shall not exceed eighty thousand square feet, unless the building is divided by a solid wall of masonry for each additional 80,000 square feet of floor area, or fractional part thereof; and shall extend at each end not less than one foot beyond the enclosure of said building and such wall shall be subject to the approval of the Commissioner of Buildings.

(c) Houses to be used exclusively for the storage of ice, located outside of the fire limits, and contiguous to railroad tracks and not within one hundred feet of any other building, may be constructed of frame with incombustible roofing, and the floor area of any such building shall not exceed 20,000 square feet unless the building is divided by a solid wall of masonry for each additional 20,000 square feet of floor area or fractional part thereof; said wall shall extend at least one foot beyond the enclosure of said

building on each end and shall be approved by the Department of Buildings.

(d) All dividing walls must extend through and above the roof of any building in which they are built to a distance of three feet and must be covered with incombustible coping. No dividing wall shall be of less thickness than twelve inches at any point thereof.

ARTICLE XIX.

Stairways.

878. **Stairways, Number—Location—Construction.** (a) Fireproof office buildings existing at the time of the passage of this ordinance which are equipped either with one stairway and two or more stairway fire escapes or with two stairways and one or more stairway fire escapes, shall not be required to have additional stairways or stairway fire escapes.

(b) Except as otherwise expressly provided in this Article, it shall be unlawful to construct or maintain any building or structure of Classes I, II and VII unless its stairway or stairways comply with the following provisions:

(c) In every existing building of ordinary construction having an area greater than 9,000 square feet or of mill or slow-burning construction greater than 12,000 square feet, there shall be not less than three stairways. The width of stairs shall be at least eighty per cent of the width of stairs as computed by the formula given herein and in no case less than twelve feet.

(d) Every building shall have at least one stairway from the ground to the top floor and one stairway from the lowest basement or cellar to the street grade, and no stairway shall be less than three feet in width.

(e) The width of stairs required for a building shall be construed as the total width of all stairways required on the building. Stairs shall be measured between the wall and handrail for a single stair and between handrails where two or more handrails are required by this chapter.

The aggregate width of door openings at, or approximately at the street level in buildings of all classes shall be equal to the aggregate width of stairways as specified in this article. The use of revolving doors shall not be permitted in any building of Class Iic or of Classes III, IV, V, VIII or IX.

(f) In buildings of Class I and Class Iia the width of stairs and fire escapes required for a building shall be determined by the floor area measured on the third floor of the building and such area shall not include walls, columns, stairs, elevator shafts, well holes, chimneys and corridors. In all cases where the building is less than three stories in height the width of stairs shall be determined by the floor area of the second floor as hereinafter specified.

(g) Where the enclosed space between a ceiling and the roof of a building of any Class is of greater average height than two feet in the clear, access shall be provided by means of at least one stairway not less than three feet wide leading from a public hallway or corridor.

(See Illustration, Sec. 613).

879. **Stairs—Number and Width of in Classes I, II and VII.** (a) In buildings of Class Iib, Class Iic and Class VII the number and width of the stairs and fire escapes shall be determined by the area of that portion of the third floor not occupied by walls, columns, stairs, elevator shafts and well-holes.

In buildings of Class I, II and VII the number and width of stairs required shall be as follows:

(b) IN ORDINARY CONSTRUCTION.

With floor area of 5,000 square feet or less, two stairways;

With floor area of 5,000 to 9,000 square feet, three stairways.

Provided, however, that in buildings of ordinary construction, existing prior to December 5, 1910, with floor area of 5,000 square feet or less, one stairway only shall be required where the building is also equipped with an outside stairway fire escape, and in all such buildings with floor area of from 5,000 to 9,000 square feet, two stairways only shall be required; in case such building is also equipped with an outside stairway fire escape. Where such buildings are equipped with ladder fire escapes, erected in compliance with the ordinance now in force, one-half the width of such ladder fire escape shall be credited in computing the width of stairs required therein.

(c) The width of stairs required in buildings of ordinary construction shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in square feet and multiplying the remainder by twelve and dividing the product by 1,000 and adding 72 inches to the quotient, expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}-3000) \text{ times } 12}{1,000}$$

(d) IN MILL OR SLOW-BURNING CONSTRUCTION.

With floor area of 6,000 square feet or less, two stairways.

With floor area of 6,000 to 12,000 square feet, three stairways.

(e) The width of stairs required in buildings of mill or slow-burning construction shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in square feet and multiplying the remainder by eight and dividing the product by 1,000 and adding 72 inches to the quotient; expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}-3,000) \text{ times } 8}{1,000}$$

(f) IN FIREPROOF CONSTRUCTION.

With floor area of 7,000 square feet or less, two stairways.

With floor area of 7,000 to 15,000 square feet, three stairways.

With floor area of 15,000 to 21,000 square feet, four stairways.

With floor area of 21,000 square feet and over, five stairways.

(g) Provided, however, that in fireproof buildings having an area of 21,000 square feet or more only four stairways shall be required if such building is completely equipped with an approved automatic sprinkler system.

(h) The width of stairs required in buildings of fireproof construction shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in square feet and multiplying the remainder by six and dividing the product by 1,000, and adding 72 inches to the quotient; expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}-3,000) \text{ times } 6}{1,000}$$

(i) Provided, however, that where buildings of Class I are of fireproof construction and are used solely for storage warehouse purposes and the number of persons employed on any one floor does not exceed the number specified hereafter in this sec-

tion they shall comply as to number of stairways as follows:

With floor area less than 8,000 square feet where not more than ten persons are employed on a floor, two stairways.

With floor area greater than 8,000 square feet and less than 15,000 square feet where not more than fifteen persons are employed on a floor, three stairways.

With floor area greater than 15,000 square feet where not more than twenty persons are employed on a floor, four stairways.

(j) The width of stairs shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in square feet and multiplying the remainder by four and dividing the product by 1,000, and adding 72 inches to the quotient; expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}-3,000) \text{ times } 4}{1000}$$

(k) Provided, however, where buildings of Class I are used solely for storage or warehouse purposes and the number of persons regularly employed above the floor nearest the street level does not exceed ten persons or where the number of persons occasionally employed above the floor nearest the street level does not exceed twenty persons, the floor area of such building may be increased fifty per cent (50%) in excess of the area limits as provided in this Section for buildings of Class I of ordinary, slow-burning mill or fireproof construction for the given number of stairways. The width of such stairways shall be as determined by use of formula given for each separate type of construction, by using two-thirds of the actual floor area of such building as a basis for the calculation, and by substituting the words and figures, "54 inches," for the words and figures, "72 inches," where they occur in said formula. There shall be not less than two stairways, or one stairway and a stairway fire escape directly accessible from each area of such building, and the location of all stairways and fire escapes shall be subject to the approval of the Commissioner of Buildings. The minimum width of any stairway in such buildings now in existence shall be not less than thirty inches (30"), the minimum width of any stairway in such buildings hereafter erected or hereafter converted to such use shall be not less than thirty-six inches (36"), and the minimum width of any fire escapes shall be not less than twenty-four inches (24").

880. Stairs — Handrails — Other Requirements. (a) The width of stairway fire escapes and three-quarters of the width of sliding fire escapes required by this chapter may be deducted from the width of stairs required.

(b) Stairways shall be located as far from each other as practicable. The bottom of each stairway shall be in the immediate vicinity of the top of the stairs leading to the next lower story and the line of travel from stairway to stairway shall be direct and easily accessible each to the other. At least one stairway shall extend to the roof of every building. In Classes I, II and VII, the whole number of stairways required for each building shall be complete in every respect from the first to the topmost story.

(c) Every story below the street grade shall have not less than two stairways to the first story and each such stairway shall be not less than three feet wide, but where a basement or cellar is used for the retail sale of goods the stairway from such basement or cellar shall in number and aggregate width comply with the requirement of this section for the first four stories above sidewalk grade.

(d) Where two areas of the same building adjoin and are separated by fireproof dividing walls they may have a stairway in common, provided such stairway is not less than five feet wide and is inclosed in all stories of the building by fireproof walls in non-fireproof buildings and by fireproof partitions in fireproof buildings; and where the stairways and landings are built as required by this chapter for buildings of fireproof construction, and where the doors, frames, sashes and casings, and the glazed portion thereof are built as described in Section 784 and 789 then in such case such stairway may be considered as equivalent to one open stairway from each such area, and where such stairway provides exit from only one floor area such stairway may be considered as equivalent to two open stairways but in no case shall there be less than two stairways in any such building except as otherwise provided in this chapter.

(e) Where adjoining buildings or buildings on opposite sides of an alley or other open space, and of the same class, used by the same person, firm or corporation, are connected by fireproof bridges or passageways with fireproof doors at each end, or by fireproof doors on each floor built and equipped as required by this chapter for dividing wall doors if such bridge or passageway or fireproof door is located as far as practicable from the stairways in both said buildings, then said bridge or passageway or fireproof door may be considered to be equivalent to a stairway for each of the two areas.

(f) In buildings of Classes I, II and VII, where an interior stairway is enclosed in a tower and built as required by the provisions of Section 881 paragraph (n) of this Chapter, then such stairway shall be considered the equivalent of two stairways, or a stairway and a fire escape; provided, however, that if such stairway is considered the equivalent of two stairways the building must be equipped with a stairway fire escape, or fire escapes, as is required by this Chapter.

(g) Exterior stairways in buildings of Class I, II and VII built entirely of steel and iron, having ice-proof treads not less than ten inches wide from nosing to riser and a rise of eight inches or less for each riser, and otherwise made as required for stairway fire escapes in this chapter and where such stairway fire escape extends from the inside grade to the top floor of the building or is supplied from the second floor to the ground with a counterbalanced section and has a steel ladder from the top landing to the roof, then such stairway may be considered the equivalent of one interior stairway and one stairway fire escape if the width of such stairway and that of the one or more stairways in the building equals the width of stairs required by this chapter; provided, that in such case the respective floors, door sills, and stairway platforms are flush, and that the doors do not obstruct the stairs or platforms and that the doors are each at least 90 per cent of the width of said stairway and that the windows, doors and frames passed by such stairway and platforms are built of incombustible material and wired glass.

(h) In buildings of Class I not more than three stories in height, a stairway fire escape not less than three feet wide located and built as required by this chapter for such fire escape and placed as far as practicable from the stairway, may be considered as a stairway and may be deducted from the "width of stairs" required for the building.

(i) The width of different stairways need not be alike, and for each four stories or fractional number of stories of the building above the first four stories each stair-

way may be reduced six inches, but no stair in a Class VII building shall be less than three feet in width.

(j) Stairways which are less than three feet three inches wide shall have not less than one hand rail and stairways which are more than three feet three inches wide shall have not less than two handrails. Stairways which are over eight feet wide shall have double intermediate handrails with end newel posts at least five and one-half feet high at all stair landings.

(k) Stairways hereafter erected shall not be spiral stairways or have any winders. Provided, however, that circular or elliptical stairways may be used if the width of treads one foot from the center of the handrail next to the well-hole is nine and one-half inches, including nosings.

(l) Stairways shall not have risers more than eight inches high nor treads less than ten inches wide, inclusive of nosings.

(m) The bottom of any counter-balance stairway or ladder fire escape hereafter erected on any public thoroughfare when raised shall be not less than fourteen feet above the pavement or surface of the street or alley.

(n) The location of every stairway required by this article shall be subject to the approval of the Commissioner of Buildings.

(See Illustration, Sec. 613).

ARTICLE XX.

Fire Escapes.

881. Fire Escapes—Number and Location. (a) It shall be unlawful for any person, firm or corporation to construct or maintain any building of Classes I, II, III, VI, and VII within the city, unless the same shall be equipped with fire escapes as follows:

(b) Every building four or more stories in height, except such as is used exclusively for a residence for one family shall have one or more incombustible sliding or stairway fire escapes, as required by this chapter, except as otherwise herein provided.

(c) There shall be at least one stairway fire escape constructed as required by the provisions of this chapter for each 250 persons, or fractional part thereof, who occupy any floor of any building habitually and daily or for whom working, sleeping or living accommodations are provided on any one floor above the third floor of any building or structure.

(d) BUILDINGS OF ORDINARY CONSTRUCTION SHALL BE EQUIPPED WITH FIRE ESCAPES AS FOLLOWS:

With floor area of 6,500 square feet or less, one 24-inch stairway fire escape.

With floor area of 6,500 square feet to 9,000 square feet, two 24-inch stairway fire escapes.

(e) BUILDINGS OF MILL OR SLOW-BURNING CONSTRUCTION SHALL BE EQUIPPED WITH FIRE ESCAPES AS FOLLOWS:

With floor area of 8,000 square feet or less, one 24-inch stairway fire escape.

With floor area of 8,000 square feet to 12,000 square feet, two 24-inch stairway fire escapes.

(f) BUILDINGS OF FIREPROOF CONSTRUCTION SHALL BE EQUIPPED WITH FIRE ESCAPES AS FOLLOWS:

With floor area of 10,000 square feet or less, one 24-inch stairway fire escape.

With floor area of 10,000 to 20,000 square feet, two 24-inch stairway fire escapes.

With floor area of more than 20,000 square feet, three 24-inch stairway fire escapes.

(g) FIREPROOF WAREHOUSE BUILDINGS SHALL BE EQUIPPED WITH FIRE ESCAPES AS FOLLOWS:

With floor area of 12,000 square feet or less, one 24-inch stairway fire escape.

With floor area exceeding 12,000 square feet, two 24-inch stairway fire escapes.

(h) A fireproof bridge built as described in Section 880 and connecting each floor of two neighboring buildings occupied by the same person, firm or corporation, shall be considered the equivalent of a fire escape, or of an interior stairway, but not the equivalent of both.

(i) In buildings of Class II there shall be a stairway or a fire escape as near as practicable to the end of each corridor, and where a corridor is endless the stairs and the fire escapes shall be located around and connected to said hall or corridor at distances approximately equal to each other.

(j) The openings leading to fire escapes on hospitals shall be flush with the floor leading to the fire escape which may be inclined not more than $2\frac{1}{2}$ inches vertical to 12 inches of horizontal measurement, and shall be constructed and maintained with no obstructions thereon.

(k) In buildings hereafter erected wherever stairway fire escapes are considered the equivalent of an interior stairway or as taking the place of any of the "Width of Stairs" required by this chapter, there shall be a door or casement window leading to such fire escape from each floor. Windows and doors to such fire escapes shall not be less than 24 inches in width and not less than 72 inches in height. The sill of such windows or doors shall not be more than 24 inches above the floor, unless a stair is built leading to the same.

(l) Where a building is divided into separate areas, each such area shall be considered as a separate building and shall be equipped with stairs and fire escapes as is required for buildings by this chapter, unless otherwise herein provided.

(m) Exterior stairway fire escapes built as required by this chapter and having treads not less than 10 inches wide from nosing to riser and risers not more than 8 inches in height and having stairways extending from the inside grade to the top floor of the building or having a counter-balance section from the first story to the ground and a steel ladder from the top landing to the roof, shall be considered the equivalent of one interior stairway and one stairway fire escape, if the width of such stairway fire escapes with that of one or more stairways in the building equals the "Width of Stairs" required for the area of the respective buildings by this chapter.

(n) Where a Fire Shield Stairway is constructed according to the following provisions and requirements, such Fire Shield Stairway shall be considered the equivalent of a stairway or stairways or a fire escape and stairway or stairways combined, as per the provisions of Paragraph "f" of this section.

The Fire Shield Stairway shall be divided or separated from the building by, and completely enclosed with, brick walls or walls of fireproof material not less than twelve inches thick, or by a wall of reinforced concrete and tile in combination not less than ten inches thick subject to the approval of the Commissioner of Buildings. The walls are to be built from the lowest floor level to and at least thirty-six inches above the roof, except as otherwise herein provided. The roof shall be built of fireproof construction. The stairs shall be of fireproof construction, and all door openings must be provided with fireproof thresholds, metal frames and approved incombustible doors. The risers of all stairs shall be not more than eight inches and the tread not less than nine inches, and winders in stairs shall not be permitted. The nearest riser of the stair in a downward direction must be remote from the entrance to the Fire Shield Stairway a distance not less than the width of

the stairs. The entrance shall be by a fireproof vestibule or by an outside balcony. Said balcony shall be constructed on private property and shall not encroach on or overhang a public street or alley. Said vestibule or balcony shall be not less than five feet wide and the floors, ceiling and sides thereof shall be of fireproof material. One side of said Fire Shield Stairway shall face a street or alley or an open space leading directly to and connecting with a public street or alley. The side of said vestibule facing the street, alley or other open space, shall be open for the full width thereof from a point four feet above the floor to the underside of ceiling in each story.

The open space above said wall may be enclosed by a fire shield in the following manner only:

A metal frame constructed of steel of commercial shape, or a sheet metal frame filled with concrete, with a horizontal cross piece midway between the top and bottom of said frame, may be fitted in the opening flush with the inside face of the wall. This frame may be hung with two sashes, sash to be of metal and glazed with fire-resisting glass, hinged at the bottom and arranged to open out from the top, and restrained by angle iron or chain attached to the inner part of jambs of the opening, so as to allow sash to rest on same in an open position, in such a manner that the top edge of sash will be flush with the outer face of the wall. The mason work at the head of the wall opening shall be beveled off at an angle of forty-five degrees. The opening and closing of these sashes are to be controlled by a mechanical device to be approved by the Commissioner of Buildings. Where sash exceed five feet in width, intermediate piers of masonry sixteen inches wide by the breadth of wall in thickness may be built, and the resulting openings shall be each treated as hereinbefore stated. All metal sash and fire-resisting glass installed shall be subject to specifications and requirements elsewhere contained in this chapter.

The entrance from the building into the Fire Shield Stairway shall be through the vestibule or by means of the balcony only. All openings from the building to the balcony or vestibule and from the balcony or vestibule to the Fire Shield Stairway shall be not less than six feet nor more than seven feet in height and not less than four feet in width, and shall be provided with approved incombustible doors hung in metal frames and may be glazed with fire-resisting glass. In all cases, the floor of the vestibule or balcony, or floor landing of stairs, and the floor of the building containing Fire Shield Stairway shall be at the same level.

Where balconies are used as a means of access from the building to the Fire Shield Stairway, the floors of same shall be solid and built of fireproof material, and shall be of sufficient strength to sustain a load of one hundred pounds per square foot within the safe limits of stress for materials, as elsewhere specified in this chapter. Said balcony on each story shall be provided on the open side with an incombustible enclosure four feet high. There shall be a sufficient number of windows in the wall between the vestibule and stairway, or the doors to stairway shall be fitted with fire-resisting glass of sufficient area to properly light the said Fire Shield Stairway. All window openings shall be equipped with metal frames and sash and fire-resisting glass. The entire stairway, vestibule and balconies on all floors shall be provided with adequate means of illumination by gas or electricity on a separate circuit, and shall be lighted during all the time any part of the building in which they are located is being used after sunset or whenever lighting shall be required. The Fire Shield Stairway shall terminate at a landing on a level with, or not to exceed six inches above the street, alley or other open space on which

faces; and access from said landing to said street, alley or other open space, shall be direct by means of an incombustible door or doors equipped with a metal frame and fire-resisting glass, not less than six feet nor more than seven feet in height, and not less than four feet in width. Connection to said Fire Shield Stairway from first floor will not be required if first floor has sufficient exits properly located. All doors to Fire Shield Stairway shall be of the style known as "double acting doors." In buildings other than skeleton construction a slip joint must be provided in the masonry walls between the tower and any wall connecting or abutting thereto, subject to the approval of the Commissioner of Buildings.

Plans in detail, showing the construction and equipment and all other features of a Fire Shield Stairway shall be submitted in addition to the general plan showing the proposed location of same. Such details shall be drawn to an enlarged scale, and shall consist of a typical floor plan, a typical elevation and cross section of one or more stories and other stories which deviate from typical plan, and shall be approved by the Commissioner of Buildings before a permit for construction of same is issued.

(o) In buildings not more than two stories in height one stairway may be omitted if the building is equipped with a three-foot stairway fire escape built as required for fire escapes in this section with counter-balance drop and placed as far as practicable from the remaining stairway.

(p) Where fireproof buildings have a frontage upon public alleys or have courts of an area of not less than 320 square feet, and where such courts lead directly to a public thoroughfare, fire escapes may be erected on such courts or such alleys and shall not be required to be erected upon the street fronts of such buildings. Such fire escapes shall be located as far as possible from stairways in the buildings, and where it is possible to erect the fire escapes on an alley or in a court they may be thus erected subject to the approval of the Commissioner of Buildings.

(q) In fireproof buildings of Class IIa, fire escapes may be located in light courts of fifty feet in the least dimension, having no opening onto a street or alley, but such fire escape must be connected with a stairway of the building at a level no higher than twenty-five feet above finished grade at the building, said stairway to terminate at the first floor level in a public corridor, giving direct egress from the building.

(r) Such fire escapes shall not be considered as part of the width of stairs as defined in Section 878 of this chapter for such buildings unless that portion of the stairway used in connection with the fire escape is increased by the width of the fire escape, from their junction to the ground.

Hospitals two or more stories in height shall be provided with one or more stairway fire escapes not less than 40 inches between handrails. Sliding fire escapes shall have a radius or width of not less than 42 inches. Sliding fire escapes shall not be built on public thoroughfares and shall deposit the person from same not more than twenty-four inches from the surrounding ground, and sliding fire escapes on Class VIII buildings shall be constructed, located and maintained in accordance with the provisions relating to Class VIII.

Wherever stairway fire escapes are considered by this chapter to be the equivalent of an interior stairway or as taking the place of any of the width of stairs, there shall be a door leading to said fire escape from each floor. Such door shall not be less than 24 inches in width and not less than 72 inches in height. The sill of such door shall not be more than 24 inches above the

floor and the door shall be as wide as the stairway required on the fire escape. Where the sill is more than 24 inches from the floor, a small stairway shall be built from the floor to the window sill with treads not less than 10 inches wide and risers not more than 9 inches in height.

(s) A stairway fire escape placed on an exterior wall adjacent to a dividing or party wall shall be considered as a stairway fire escape for each building area to which it is adjacent. In such cases there shall be at least one door or window from each building area leading to the fire escape platform, and the width of each such fire escape shall not be less than 36 inches.

(t) All fire escapes shall be located and constructed to conform to the building for which they are respectively intended.

(u) If any building used wholly or in part for the purposes of Class VII be equipped with automatic sprinklers, and be connected with another building similarly used, and distant not less than twenty-five feet and used by the same occupant, by a fireproof bridge or passageway similarly equipped, then each such tier of bridges or passageways shall be held to be equivalent to and take the place of one outside stairway fire escape on each of the buildings so connected.

(See Special Ruling VI, Page 258.)

882. Stairway Fire Escapes—Fees—Erection of—Location—Component Parts. (a) The Commissioner of Buildings and his assistants shall determine upon the location of all stairway fire escapes before erection of same is commenced.

(b) Before the work is commenced a permit shall be obtained from the Commissioner of Buildings in accordance with Provisions in Section 442.

(c) No permit for a stairway fire escape more than twenty-four inches in width shall be granted unless a detailed plan for the fire escape, approved by a licensed architect or a structural engineer, is submitted to the Commissioner of Buildings, and a copy of such plans shall be left on file with said Commissioner.

(d) All anchors for stairway fire escapes shall, wherever possible, pass through the wall of building and be secured on inside of same. Where it is possible to anchor through walls, anchors shall be put in wall not less than fifteen inches at an angle of thirty-five degrees. On buildings of steel construction, where walls are less than twenty inches in thickness there shall be steel channels at least four inches wide set on inside of building from column to column and bolted or riveted to columns, and anchors shall be bolted on inside of channels.

(e) Anchors for a platform four feet two inches or less in width shall be made of one inch square iron; over four feet two inches and not over six feet, shall be one and one-fourth inch square iron with brace; over six feet shall be one and one-half inch square iron with brace. All anchors shall be turned up not less than eight inches at the outside of the platform on which to bolt the post.

(f) Braces shall be the same thickness as the anchors. The spread of the braces shall be the width of the platform. Where the platforms are over five feet in width, anchors shall have double braces, one to the outside and one to the center of the platform.

(g) Platforms shall be not less than fifty inches wide at ends; passageways shall be not less than twenty-four inches between buildings and railings. Platforms shall be not less than five feet in length. The frames and crossbars shall be made as provided in this chapter. Platforms shall have

clips at each end bolted to anchors. No door or window or shutter shall open so as to obstruct in any way the free passage on or along a platform or a stairway fire escape.

(h) All stairway fire escapes for apartment buildings, hotels, boarding houses, factories and office buildings, where there are less than 100 people on any one floor, shall be not less than two feet wide between hand rails. Stringers for a 24-inch stairway fire escape shall not be less than 2 inches by $\frac{3}{4}$ inch set $1\frac{1}{2}$ inches apart. Where stairway fire escapes and their balconies and supports are designed and constructed in accordance with the provisions of this chapter relating to materials permitted for such stairway fire escapes, balconies and supports, so as to sustain a load of 100 pounds per square foot, they may be built of steel channels, angles, or I-beams, but when so constructed, they shall comply with the provisions of this chapter in all other respects. All stairway fire escapes for halls, churches, theaters, hospitals, schools, department stores and buildings where large numbers of people congregate shall not be less than three feet wide in the clear, and all passageways shall not be less than three feet wide in the clear. Stringers for a 36-inch stairway fire escape shall be made of two bars, 3 inches by $\frac{1}{2}$ inch, about one inch apart, or 4 $\frac{1}{2}$ inches by $\frac{3}{4}$ inch flat iron, or of steel channels, angles or I-beams; where over 12 feet in length, they shall have anchor and brace in the center. The tread shall be made of one-half inch square steel or iron, corner upwards, not to exceed 1 $\frac{1}{2}$ inches center, riveted at ends to 2 by $\frac{1}{2}$ inch flat iron or steel. There shall be not less than four bars to a tread where treads are less than twenty-seven inches in length; where treads are over twenty-seven inches in length there shall be not less than six bars to a tread; there shall be a truss supporting treads made of bar iron 2 inches by $\frac{3}{4}$ of an inch in thickness riveted to bars of treads in center, supported by not less than two inches by seven-sixteenths of an inch rods bolted at each end of treads. All stairs shall have an incline of about forty-five degrees. The rise shall be not more than nine inches and the tread not less than nine inches.

(i) All stairs shall have three bar railings made of one-inch bar iron for top rail, and three-fourths inch bar iron for lower rail, and when such stairs are more than three inches from the wall of the building, there shall be one or more hand rails on the wall side of such stairs.

(j) All posts used for stair fire escapes shall be made of one and one-half inch angle or channel iron not less than three feet six inches high, measured at right angles with the treads of such fire escapes, and shall have braces on the outside turned upwards and fastened to the frame of the balcony or stairs, which shall be not less than half way up the posts; all stair fire escapes shall extend to the ground either by counterbalance drop or stairs. All ladder fire escapes shall have either extension ladder or counterbalance drop from the first story of said building to the ground or sidewalk. All fire escapes if not continued to the roof shall be equipped with a ladder built in conformity with the specifications for ladder fire escapes contained herein from top story or attic platform to the roof. Their location, material and construction shall be subject to the approval of the Commissioner of Buildings. When cables are used for counterbalance stairs they shall not be less than three-quarters of an inch in size and shall be well oiled or greased when hung up and shall be oiled or greased at least twice a year. All pulleys and cables holding counterbalance drop shall be covered at bracket so as to be protected from snow or ice.

(k) Wherever a stairway fire escape passes a window or door on buildings hereafter erected, the windows or doors shall be of wired glass and shall have metal frames and sash, and whenever such a fire escape passes above a window, door or other opening not fitted with wired glass and metal frames the said fire escape shall be protected on the under side by sheet metal of not less than No. 20 United States gauge opposite such opening and for a distance of three feet on each side thereof. The use of intermediate platforms shall be permitted on all buildings now built or hereafter constructed whenever it is possible by their use to avoid the necessity of stairway fire escapes passing windows. All fire escapes shall be painted with two coats of mineral paint when erected, one at the shop and one upon completion at the building, and they shall be painted at least once every year thereafter.

(l) Wherever it is impossible to erect stairway fire escapes according to the provisions of this chapter, plans shall be submitted to the Commissioner of Buildings showing the location, material and construction of such stairway fire escapes as are proposed to be built before a permit is issued for the same, and if found to be impracticable to locate and construct fire escapes in accordance with the provisions of this chapter and that fire escapes built according to the plan presented would afford safe and practical means of exit from the building on which they are to be placed, then the Commissioner of Buildings may in his discretion approve the same. All such fire escapes shall be inspected by the Commissioner of Buildings on their completion and if found to be safe, satisfactory and in compliance with said approved plans, a certificate shall be issued to such effect upon the payment of \$2.00 to the City Collector. All fire escapes other than such as it is impossible or impracticable to build in accordance with the provisions of this chapter shall be inspected by the Commissioner of Buildings on their completion, and if found to be in compliance with the provisions of this chapter a certificate shall be issued by the Commissioner of Buildings upon the payment of a fee of \$2.00 to the City Collector.

(m) It shall be unlawful for any person, firm or corporation to use any building requiring fire escapes under the terms of this article until the provisions of this article shall have been complied with.

883. Ladder Fire Escapes—When Permitted. Where a building of Class III or VI, not more than four stories in height has two flights of stairs leading from the ground to the top floor of the building and where also each occupant shall have access to at least two separate and distinct stairways located as required by the provisions of this chapter from the top floor to the ground, a ladder fire escape may be used in lieu of the stairway fire escape required herein, where a counter balance drop is placed from the ladder fire escape to the ground.

884. Specifications for Ladder Fire Escapes. (a) All single and double ladder fire escapes hereafter erected shall be in strict accordance with the following provisions:

(b) There shall be not less than three one-inch square wrought iron anchors to every five-foot balcony and not less than six for a twelve-foot balcony. Such anchors shall pass through the wall of the building and be bolted on the inside with a three-fourths by two-inch nut and three and one-half inch iron washer back of the nut, where the wall is not over twenty inches thick; but where the wall is over twenty inches thick anchors shall be inserted at

least eight inches into the wall at an angle of thirty-five degrees.

(c) Where a ladder fire escape is permitted by this chapter, the side guards shall be two by three-eighths inch flat iron. All ladder fire escapes shall be seventeen inches or more in width in the clear. No pipe nor rusted or defective material shall be used in the construction of ladder fire escapes. Rungs of ladders shall be of not less than one-half inch square iron with corners upward so as to give a safe footing. Rungs shall be riveted and shall be constructed with fourteen-inch centers.

(d) The brace for the anchors shall be at least twenty inches spread and shall extend into the wall four inches; no other form of anchor shall be allowed except by special permit from the Commissioner of Buildings.

885. Balconies—Construction of. All balconies hereafter erected shall be either steel or wrought iron and capable of sustaining a weight of one hundred pounds to the square foot. The balcony frame shall be made of not less than two-inch by two-inch by one-fourth inch angle iron which shall be securely riveted together with crossbars every two feet. Such bars shall be punched one-half inch square close to the top of the bar on two inch centers and one-half inch square iron bars shall be forced through the same. The crossbars shall be securely riveted to the angle iron frame. The crossbars for a balcony twenty-eight inches wide shall be two inch by three-eighths inch. Balcony frames over twenty-eight inches wide shall be made of not less than two by three-eighths inch iron and made to conform with the increased dimensions of iron in crossbars; for thirty-six inch balcony or more they shall be two and one-half inch by three-eighths inch. All balconies over this width shall have a two-inch "T" iron through the center of the balcony for the bars to rest upon; provided that such balconies and platforms of buildings of Class IIC may be built as described in Section 482 of this chapter. Such balconies shall have a substantial cast or wrought iron post every three feet bolted to the balcony. No balcony shall have less than three guard rails which shall be of wrought iron or new iron pipe not less than three-fourths inch in diameter and the ends shall be securely anchored to the wall of the building and shall be not less than ten inches on an angle of thirty-five degrees. Where stairway fire escapes and their balconies are designed and constructed in accordance with the provisions of this chapter to sustain a load of one hundred pounds per square foot, they may be built of steel channel angles or I-beams, but in such cases they shall comply with the requirements of this chapter in all other respects.

886. Stairs and Fire Escapes—Change in Construction. No change in the position of any existing fire escape or stairway shall be made, nor shall any change in the position of any stairway or fire escape as shown on approved plans be permitted, unless the written consent of the Commissioner of Buildings shall first have been obtained.

ARTICLE XXI.

Elevators and Their Enclosing Walls.

887. Elevator—Passenger and Freight—Permit for Construction. (a) Before proceeding with the construction or alteration of any passenger or freight elevator, except such as are hereinafter specially exempted from the provisions of this chapter, a permit for such construction or alteration shall be obtained from the Commissioner of Buildings either by the owner or agent of the building in which such ele-

vator is to be constructed or in which such alterations are to be made, or by the contractor who is about to construct or alter such elevator.

(b) It shall be unlawful for any such owner, agent, or contractor to permit or allow the construction of any such elevator or the making of such alterations, or to proceed with or in or about any of the work of construction or alteration of any such elevator until such permit shall first have been obtained. Such permit shall be issued by the Commissioner of Buildings after application shall have been made to him therefor by any such owner, agent or contractor, specifying the number and kind of elevators which it is desired to construct, or the nature of the alterations to be made and the location of the building or structure in which the same is or are to be placed or made. Such application shall be accompanied with such plans and specifications as shall be necessary to advise and inform said Commissioner of the plan of construction, type of elevator, kind of alterations and the location thereof. If such plans and specifications shall show that such elevator or elevators is or are to be constructed or erected or altered in conformity with the provisions of this chapter, the Commissioner shall approve the same and shall issue a permit to such applicant upon the payment of such applicant of a fee of two dollars for each elevator to be constructed, erected or altered, and such fee shall be known as a permit fee and shall not be held to cover the cost of any inspection which shall at any time thereafter be made of such elevator or elevators when constructed, or of any alterations made.

888. Fee.) All contractors or persons, firms, or corporations, engaged in the manufacture and work of installing iron doors on passenger or freight elevators, or of installing wire work enclosures around elevators, shall secure a permit from the Commissioner of Buildings for the work on each such elevator, the fee for which shall be two dollars for each elevator in buildings of four stories or less in height, and in buildings of more than four stories in height fifty cents additional shall be charged on each elevator for every additional floor in excess of such four stories.

889. Unlawful to Proceed Without Permit.) It shall be unlawful for any person, firm or corporation either as owner, lessee, contractor or agent of any building or structure in which any elevator or elevators are to be constructed or altered to proceed with said work without securing a permit as herein required for such construction or alteration, and no such permit shall be issued until such person, firm or corporation, lessee, contractor or agent shall have complied with all the requirements of this chapter.

890. Inclosure of Elevator Shafts in Non-Fireproof Buildings.) In all non-fireproof buildings erected after March 13, 1911, all passenger elevators and all freight elevators, except such as are expressly excepted by this chapter, shall be inclosed in a wall of brick, tile or such incombustible material as may, from time to time, be approved by the Commissioner of Buildings as proper and suitable for the purpose; such inclosure shall extend from the foundation to the roof of such building, and shall be supported independently of the floor construction; provided, however, that the requirements of this section shall not apply to any non-fireproof building which is equipped throughout on every floor and in every room thereof and in all stairways, platforms, elevator shafts, elevator hoistways and well holes with an automatic sprinkler system approved by the Chief Fire Prevention Engineer.

891. Inclosure of Pits and Shafts in Basements.) In all buildings heretofore or

hereafter erected, not included in Section 890, whenever any elevator shaft extends down into a basement or sub-basement, that portion thereof extending below the level of the floor of the first story shall be inclosed in walls of brick, tile or other fireproof material, and the door openings in such enclosure shall be protected by incombustible doors. Where such elevator shafts do not extend down into the basement they shall be provided with fireproof pits at the lowermost floor level above which they serve, and such pits shall have no openings except for cables or other elevator equipment.

892. Inclosure of Dumb Waiter Shafts—Materials.) In all non-fireproof buildings hereafter erected, the dumb waiter shafts shall be inclosed with brick, tile, reinforced concrete, or cement plaster not less than two inches thick or metal studs and lath.

893. Doors—On Elevators.) In all elevator shafts which are herein required to be enclosed with fireproof walls, the door openings shall be equipped with doors of incombustible material, which shall be made to open from the outside by means of a key or other device satisfactory to the Commissioner of Buildings.

894. Hatch Doors—Freight Elevators.) Elevators, used exclusively as freight elevators constructed and in operation at the time of the passage of this ordinance need not have enclosing walls, but in all such cases there shall be at every floor through which such freight elevators pass automatic hatch closers or automatic doors, made in such manner that they will fully close each well hole when the temperature in such well hole exceeds 140 degrees Fahrenheit; and it shall be the duty of the owner, agent or person in possession, charge or control of a building in which such elevator is maintained to keep such hatch closers or doors at all times in good working order. Such automatic hatch closers shall be examined by the Commissioner of Buildings and the Chief Fire Inspection Engineer, and if said officials shall find that such doors will automatically close when the temperature at or near such doors exceeds 140 degrees Fahrenheit, and that the conditions of construction and operation of such doors or hatch closers are such that there is no reasonable probability of their getting out of order and failing to operate when required, and that in their construction or operation there is nothing that is likely to cause accidents or to interfere with the elevator service in such hatch holes which they were intended to close, and that the building in which such freight elevator is in use is equipped with stairways, fire escapes and passenger elevators sufficient to offer ample means of escape from such building in case of fire, for all persons employed or for all persons in such building, then, and in such case only, shall the use of such hatch doors or closers be permitted. All freight elevators in non-fireproof buildings shall comply with the preceding requirements of this section, or shall have inclosing walls of incombustible or fireproof construction. Such elevators are to be inspected semi-annually and oftener when, in the opinion of the Commissioner of Buildings, such inspection is necessary and such fees shall be paid for said inspection as otherwise provided in said chapter.

895. Safety Device.) (a) Every passenger and freight elevator now in operation or hereafter installed, except such as are hereinafter exempted from the provisions of this chapter, shall be provided with a speed governor and such other efficient device to secure the safe operation of such passenger or freight elevator, and to prevent the cab or car of such elevator from falling, and to secure the safety of the cab or car and its load in case it does fall, as

may be required by the Commissioner of Buildings. Such speed governor and other devices shall be subjected to such a practical test as may be determined by the Commissioner of Buildings for the purpose of ascertaining the efficiency of such safety device.

(b) It shall be the duty of the Commissioner of Buildings to make such test of each and every device upon all elevators, and no elevator shall be permitted to be run until such test has been made.

(c) Whenever any accident shall occur causing injury to life or limb to any person, in or about an elevator, or while getting on or off an elevator, or which shall in any way impair the safety of the elevator, such accident shall be reported at once by the owner, superintendent, lessee or manager of the building, or the operator of the elevator, to the Commissioner of Buildings. No broken or damaged parts of such elevator shall be moved or displaced, nor shall repairs be made thereon, nor shall said elevator be operated until an investigation into such accident has been made by the Commissioner of Buildings or his duly authorized agent. A full report in writing of the result of such investigation shall be filed in the Department of Buildings, and the Commissioner of Buildings shall keep a complete record of all such accidents and reports thereon.

(d) It shall be unlawful for any operator of any elevator in the City wherein passengers are conveyed to start such elevator until all doors of such elevator and leading into such elevator shall be closed. It shall be unlawful for any such operator to open any of the doors of such elevator until said elevator has come to a full stop.

(e) Any person, firm or corporation violating any of the provisions of this section, or failing or neglecting to comply therewith, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense.

896. Safeguards for Elevators.) (a) Where the counterweights travel in the same hatchway with an elevator car, the portion of the car contiguous to the weights shall be protected from the top to the bottom of the car by a suitable guard.

(b) All freight elevators shall be provided with a guard at least six feet high. All elevator cabs or cars, whether used for freight or passengers, shall be provided with some device whereby the car or cab may be held in the event of accident to the shipper rope or hoisting machinery or controlling apparatus.

(c) No passenger elevator hereafter erected shall be installed with a freight compartment either below or above the car.

(d) All hoistways, hatchways, elevator wells and wheel holes in any building, whether occupied or vacant, shall be securely fenced, inclosed or otherwise safely protected, and it shall be the duty of the owner, occupant or agent of any such building to keep all such means of protection closed at all times, except when it is necessary to have the same open, in order that the said hatchways, elevators or hoisting apparatus may be used.

(e) It shall be unlawful to erect or maintain an elevator where such elevator or its counterweight descends into any passageway or thoroughfare.

(f) There shall be directly under the sheaves at the top of every elevator hatchway, a grating of steel or heavy wire mesh properly supported by steel or iron and capable of sustaining a load of not less than 500 pounds.

(g) All counterweights hereafter installed shall have their component parts so fastened together as to prevent any piece or

pieces from becoming detached from the guides should the counterweights be accidentally drawn to the top of the hatchway.

(h) Where drum counterweight cables run through or pass by the car counterweights to weights underneath, they shall be provided with a suitable covering to prevent their chafing and wearing on the counterweights.

(i) Where elevators other than hand-hoists and sidewalk elevators are not inclosed with fireproof or incombustible material, as is elsewhere herein specified in this Article, the well-hole of such elevator shall be enclosed with a wire guard not less than six feet high. The counterweights and the immediate space through which they travel must be protected from the floor to the ceiling with a wire guard or with other incombustible material. There must be on all elevators hereafter constructed a clear space of not less than two feet between the bottom of the hatchway and the level of the lower floor landing when the car is at its lowest position, and there must be a clearance of at least four feet from the top of the crossbeam of the car to the lower side of the grating under the overhead sheaves. Whenever there is conflict in regard to the manner of enclosing any elevator shaft or portion thereof between this section and Sections 890, 891 and 892, the provisions of the latter sections shall prevail.

(j) All passenger and freight elevators hereafter installed, except sidewalk or hand elevators, shall have an artificial traveling gas or electric light attached to the car and maintained in good working condition.

(k) All power driven elevators hereafter constructed or installed shall have at least two hoisting cables for the cage and two cables for each counterweight. The lifting and counterweight cables shall have at least one full turn of the cable on the drum when the car has run its limit.

(l) It shall be unlawful to change a hand-hoist to a power-driven elevator without first making application to the Commissioner of Buildings for a permit for such change, and it shall be unlawful to connect an electric motor or any other appliance to the hand elevator machinery without the approval of the Commissioner of Buildings.

(m) All elevators, except hand elevators operated by a pulley rope and sidewalk ram or chain hoist elevators, and elevators used in tunnels for freight service only, shall be equipped with a safety speed governor.

(n) Where ropes or cables are used to operate safety devices, a weight shall be properly attached to the same in such a manner as to insure the necessary tension on such rope or cables for proper performance of the safety devices.

(o) All elevators propelled by electricity shall be provided with an additional device not operated by link or sprocket chain which will automatically stop the elevator machinery when the car has reached its limit of travel. It shall be unlawful to construct or maintain any elevator equipped with a sprocket chain or link belt device or devices connecting the operating device and controller.

(p) An emergency switch which will disconnect the current shall be provided in all passenger elevators hereafter installed which are operated by an electric controller car switch, and such cars shall be so constructed that they will automatically stop when the current is disconnected.

(q) The underside of the floors or other parts of a building which project into passenger elevator shafts shall be equipped with a smooth steel guard curved and sloped from the enclosure of said elevator to the edge of such projection for the width of

the door to such elevator car and the slope of the guard plate shall not be less than sixty degrees with the horizon.

(r) The provisions of this section requiring the equipment of elevators with safety devices shall not apply to any hand hoists, elevator or hoist used solely for hoisting materials or tools in any building in course of construction, but the Commissioner of Buildings shall make such reasonable requirements as he may deem necessary for public safety in the operation of such hand hoists, elevators or hoists used solely for hoisting materials or tools in such buildings while under construction.

897. Inspection—Test—Certificate to Be Posted.) (a) Every elevator now in operation or which may be hereafter installed, together with the hoistway and all equipment thereof, shall be inspected under and by the authority of the Commissioner of Buildings at least once every six months, and in no case shall any new elevator be placed in operation until an inspection of the same has been made.

(b) It shall be the duty of every owner or agent, lessee or occupant of any building wherein any elevator is installed and the person in charge or control of any elevator to permit the making of a test and inspection of such elevator or elevators and all devices used in connection therewith upon demand being made by the Commissioner of Buildings or by a duly authorized Elevator Inspector within five days after such demand has been made.

(c) Whenever any such elevator has been inspected and the tests herein required shall have been made of all safety devices with which such elevator is required to be equipped and the result of such inspection and tests shows such elevator to be in good condition, satisfactory to the Commissioner of Buildings, and that such safety devices have been provided in accordance with the requirements of this chapter and are in good working condition and in good repair, it shall be the duty of the Commissioner of Buildings to issue or cause to be issued a certificate setting forth the result of such inspection and tests and containing the date of inspection, the weight which the elevator will safely carry and a statement to the effect that the shaft doors, hoistway and all equipment, including safety devices, are constructed in accordance with the provisions of this chapter, upon the payment of the inspection fee required by this chapter.

(d) It shall be the joint duty of the owner, agent, lessee or occupant of the building in which such elevator is located and of each person in charge or control of such elevator to frame the certificate and place same in a conspicuous place in each elevator.

(e) The words "safe condition" in this section shall mean that it is safe for any load up to the amount of weight named in such certificate.

(f) Where the result of such inspection or tests shall show such elevator to be in an unsafe condition or in bad repair, or shall show that the safety devices, or any of them, which are required by this chapter, have not been installed, or if installed, are not in good working order or not in good repair, such certificate shall not be issued until such elevator, its hoistway and its equipment or such device or devices shall have been put in good working order, satisfactory to the Commissioner of Buildings. The inspection fees herein required shall be paid either at the time application is made for inspection or upon the completion of such inspection and tests.

898. Power of Commissioner to Stop Operation of Elevators.) (a) Whenever any building or elevator inspector finds any pas-

senger or freight elevator or any of its running parts or automatic devices or other equipment out of order, or in an unsafe condition, he shall immediately report the same to the Commissioner of Buildings, together with a statement of all the facts relating to the condition of such elevator or elevators.

(b) It shall be the duty of the Commissioner of Buildings upon receiving from any inspector a report of the unsafe condition of any elevator, to order the operation of such elevator to be stopped, and to cause such elevator not to be used until the same shall have been placed in a safe condition, and it shall be unlawful for any owner, agent, lessee, or occupant of any building, wherein any such passenger or freight elevator is located within the city, to permit or allow any such elevator to be used after the receipt of a notice in writing from the Commissioner of Buildings that any such elevator is out of order or is in an unsafe condition and until said elevator has been put in a safe and proper condition as required by the provisions of this chapter.

ARTICLE XXII.

Building Contractors.

899. Building Contractors—Registry with Department of Building.) That every person, firm, or corporation engaged in the business of constructing or repairing the whole or any part of buildings or the appurtenances thereto in the City of Chicago, shall before undertaking the erection, enlargement, alteration, repair or removal of any building, for which permits are required by the ordinances of the City, register the name and address of such person, firm, or corporation in a book kept by the Commissioner of Buildings and used for this purpose.

No permit shall be granted for the erection, enlargement, alteration, repair or removal of any building unless the name and address of the person, firm, or corporation that is about to undertake the work of construction on such buildings is contained in the registration book kept for that purpose.

900. Where Masonry Work Only is Required.) When application is made for a permit and the work of construction involves masonry construction only the above provisions shall not apply to any person, firm or corporation licensed as a mason contractor or employing mason as provided in and by the ordinances of the City. Where the work of construction, for which a permit is sought involves construction other than masonry construction, any mason contractor or employing mason, licensed as aforesaid, engaged in or undertaking the work of such construction other than masonry construction must register his, their or its name or names and comply with the other requirements of this article before a permit for such work is issued.

901. Liability for Violations.) If any person, firm or corporation that is so registered shall fail, in the execution of any work for which a permit was issued, to comply with the ordinances of the City relative to the erection, enlargement, alteration, repair or removal of any building, either the Commissioner of Buildings or the Commissioner of Health may bring suit and prosecute such person, firm or corporation for such failure or violation, and in case of conviction, his, their or its name or names shall be stricken from the said registration book and shall not be re-entered or reinstated during such time as any violation exists or any judgment remains unsatisfied with regard to said conviction.

902. Reinstatements.) Any person, firm or corporation that shall have been convicted under the preceding section and had his,

their, or its name or names stricken from such registration book may have such name or names re-entered on filing with the Commissioner of Buildings a certificate signed by the City Prosecutor, the Commissioner of Buildings and the Commissioner of Health to the effect that all violations of ordinance with reference to which conviction was secured, have been corrected and are non-existent and that all claims and judgments arising from such convictions have been paid.

ARTICLE XXIII.

Billboards, Signboards, Signs, and Fences.

903. **Billboards and Signboards on Buildings—Construction—Height.)** No billboard or signboard shall be erected or placed upon or above the roof of any building or structure within the limits of the City of Chicago; and it shall be unlawful for any person, firm or corporation to attach any billboard or signboard to the front, sides, or rear walls of any building, unless the same shall be placed flat against the surface of the building and safely and securely anchored or fastened thereto in a manner satisfactory to the Commissioner of Buildings.

904. **Size and Construction of Billboards and Signboards Erected Within Fire Limits Otherwise Than on Buildings.)** The face of billboards or signboards erected within the fire limits as now defined or as they may hereafter be defined by ordinances of the City of Chicago other than signboards and billboards referred to in Section 906 hereof, shall not exceed twelve feet in height, and the same shall be constructed of galvanized iron or some other equally incombustible material, except that the stringers, uprights and braces thereof may be of wood. All such billboards or signboards shall be securely anchored or fastened so as to be safe and substantial.

905. **Height and Distance From the Ground of Billboards and Signboards Erected Within the Fire Limits.)** It shall be unlawful for any person, firm or corporation to construct or erect any billboard or signboard, except those specified in Section 906 hereof, within the fire limits of the City of Chicago at a greater height than fifteen feet six inches above the level of the adjoining street. Where the grade of the adjoining street or streets has not been established, no billboard or signboard shall be constructed or erected at a greater height than fifteen feet six inches above the level of the ground upon which such billboard or signboard is erected. The face of every billboard or signboard within the fire limits shall be of incombustible material, but the supports and framework of the same shall be of wood. The base of the billboard or signboard shall, in all cases, be at least three feet six inches above the level of the adjoining street. If, however, the level of the ground where the billboard or signboard is to be erected is above the level of the street, then the bottom of the face of the billboard or signboard must be at least three feet six inches above the level of the ground at the point where the board is to be erected. Every such billboard or signboard must be constructed and located in accordance with the provisions of this Article and shall be subject to the approval of the Commissioner of Buildings.

906. **Wooden Billboards or Signboards—Construction—Size—Exceptions.)** Billboards or signboards not exceeding twenty-four (24) square feet in area when attached to the front, sides, or rear walls of any building, so that the flat surface of same is against the building, or when erected on the ground, if not erected nearer than ten feet to any building, structure, other signboard or public sidewalk, which are used to advertise the sale or lease of the property upon which

they shall be erected, may be built of wood or other combustible material, and such billboards or signboards shall be exempt from the provisions of this article, except that they shall be safely and securely anchored or fastened and shall be so constructed, anchored and fastened that they will withstand the wind pressure specified in Section 911 of this Article. It shall be unlawful to erect any such billboard or signboard exceeding twenty-four (24) square feet in area before a permit therefor has been procured from the Commissioner of Buildings, the application for which must include the plans and specifications of such board and its supports and fastenings.

907. **Billboards and Signboards Erected Outside the Fire Limits—Construction—Size.)** It shall be unlawful for any person, firm or corporation to construct, erect or locate any billboard or signboard, except those specified in Section 906 hereof, outside the fire limits of Chicago at a greater height than fifteen feet six inches above the level of the adjoining street. Where the grade of the adjoining street has not been established, no billboard or signboard shall be constructed or erected at a greater height than fifteen feet six inches above the level of the ground upon which such billboard or signboard is erected. The base of the billboard or signboard shall, in all cases, be at least three feet six inches above the level of the adjoining street. If, however, the level of the ground where the billboard is to be erected is above the level of the street, then the bottom of the face of the billboard or signboard must be at least three feet six inches above the level of the ground at the point where the board is to be erected. The braces, supports and face of the billboard or signboard outside the fire limits may be made of wood, unless the billboard or signboard shall be erected or located so that any part of the face of said board is nearer than ten feet to any building or structure in which case the face of the same shall be constructed with incombustible material. Every such billboard or signboard shall be safely and securely constructed, anchored, fastened and located in accordance with the provisions of this article and shall be subject to the approval of the Commissioner of Buildings.

908. **Provisions of This Article Shall Apply to Other Similar Structures.)** The provisions of this article shall apply to other similar structures of like size and construction without regard to their use whether erected on or near the surface of the ground or anchored to, or fastened to any building or structure.

909. **Permit for Billboard or Signboard.)** No billboard or signboard or other similar structure such as is described in this article shall be erected or maintained within the city unless a permit shall first have been secured by the person, firm or corporation desiring to erect or maintain such billboard or signboard from the Commissioner of Buildings to whom application for such permit shall be made; and such application shall be accompanied by such plans and specifications of the proposed billboard or signboard and location of same as are necessary to fully advise and acquaint the said Commissioner with the construction of such proposed billboard or signboard. If the plans and specifications accompanying such application shall be in accordance with the provisions of this article, said Commissioner shall thereupon issue a permit for the erection of such billboard or signboard upon the payment by the applicant of a fee as hereinafter fixed.

910. **Alteration and Repair of Billboards and Signboards.)** No material alteration of any billboard or signboard nor removal from one location to another shall be made ex-

cept upon a written permit issued by the Commissioner of Buildings authorizing such alteration or removal; and such permit shall be issued upon application in writing made to such Commissioner by the owner of such billboard or signboard or by the person in charge, possession or control thereof, accompanied by a plan of the proposed alterations or repairs to be made and a written statement covering the proposed removal from one location to another and its reconstruction in the new location, which said alteration and repairs or removal shall be made in accordance with the provisions of this article and the ordinances of the City of Chicago. Where such plans, specifications and location are in compliance with the requirements of this article and are satisfactory to and approved by the Commissioner of Buildings, such Commissioner shall issue a permit upon the payment of a fee therefor as hereinafter fixed; but such alteration shall not be construed to apply to the changing of any advertising matter of any billboard or signboard, nor the refacing of the framework supporting same.

911. Wind Pressure—Strength.) All billboards and signboards now in existence, or hereafter to be constructed, erected or maintained, shall be made, constructed, erected and maintained of sufficient strength to withstand a wind pressure of twenty-five pounds per square foot of surface without stressing the material beyond the safe limit of stress given elsewhere in this chapter.

912. Height of Billboards and Signboards.) No surface billboard or signboard constructed or erected prior to the passage of this ordinance shall be maintained after six months from and after the passage of this ordinance where the height of such billboard or signboard exceeds seventeen feet, nor shall such billboard or signboard be maintained after such date, unless there is a clear space of at least three feet six inches above the level of the adjoining street. If, however, the level of the ground where the billboard or signboard is erected or maintained is above the level of the street there must be a clear space of at least three feet between the bottom or face of the billboard or signboard and the level of the ground at the point where the billboard or signboard is erected or maintained.

913. Duty of Commissioner—Owner's Name to Be Placed on Top of Billboard or Signboard—Annual Inspection.) It shall be the duty of the Commissioner of Buildings to inspect all plans and specifications submitted in connection with the erection or construction or the alteration or repair of any billboard or signboard and to approve same if the method of construction and provisions made for fastening, securing, anchoring and maintaining such billboard or signboards are such as will serve to protect the public and to render such billboards safe and substantial. It is further made the duty of the Commissioner of Buildings to exercise supervision over all billboards and signboards erected or being maintained under the provisions of this article; and to cause inspection by inspectors in his department of all such billboards and signboards to be made once each year and oftener where the condition of such boards so require; and whenever it shall appear to said Commissioner that any such billboard or signboard has been erected in violation of this article or is in an unsafe condition or has become unstable or insecure or is in such a condition as to be a menace to the safety or health of the public, he shall thereupon issue or cause to be issued a notice in writing to the owner of such billboard or signboard or person in charge, possession or control thereof, if the whereabouts of such person is known, informing such person, firm or corporation of the violation of this article and the dangerous

condition of such billboard or signboard and directing him to make such alterations or repairs thereto, or to do such acts or things, as are necessary or advisable to place such billboard or signboard in a safe, substantial and secure condition and to make the same comply with the requirements of this article within such reasonable time as may be stated in said notice. If the owner or person in charge, possession or control of any billboard or signboard when so notified shall refuse, fail, or neglect to comply with and conform to the requirements of such notice, said Commissioner shall, upon the expiration of the time therein mentioned, alter, change, tear down or cause to be torn down such part of such billboard or signboard as is constructed and maintained in violation of this article, and shall charge the expense to the owner or person in possession, charge or control of such billboard or signboard and the same shall be recovered from such owner or person by appropriate legal proceedings. If the owner of such billboard or signboard or the person in charge, possession or control thereof cannot be found, or his or their whereabouts cannot be ascertained, the Commissioner shall attach or cause to be attached to said billboard or signboard, a notice of the same import as that required to be sent to the owner or person in charge, possession or control thereof, where the owner is known; and if such billboard or signboard shall not have been made to conform to this ordinance and be placed in a secure, safe and substantial condition, in accordance with the requirements of such notice, within thirty days after such notice shall have been attached to such billboard or signboard, it shall be the duty of the Commissioner of Buildings to thereupon cause such billboard or signboard or such portion thereof as is constructed and maintained in violation of this article to be torn down; provided that nothing herein contained shall prevent the Commissioner of Buildings from adopting such precautionary measure as may be necessary or advisable in case of imminent danger in order to place such billboard or signboard in a safe condition, the expense of which shall be charged to and recovered from the owner of such billboard or signboard or person in charge, possession or control thereof in any appropriate proceedings therefor. No permit shall be issued to any applicant for permission to erect a billboard or signboard unless such applicant shall agree to place and maintain on the top of such billboard or signboard the name of the person or corporation owning same or who is in charge, possession or control thereof. It shall be the duty of the Commissioner of Buildings to require that the name of the person or corporation owning or in possession, charge or control of such billboard or signboard is placed upon such billboard or signboard forthwith upon the erection thereof and is kept thereon at all times such billboard or signboard is maintained; and in case the owner of such billboard or signboard or the person in charge, possession or control thereof shall fail or refuse to place and maintain such name on the same, such owner or person shall be subject to the penalty hereinafter provided for. Every person, firm or corporation engaged in the business of erecting billboards or signboards for the purpose of display advertising shall file with the Commissioner of Buildings within ninety days after the passage of this ordinance a full and complete report of the location and size of all existing billboards or signboards unless such record is already in the possession of the Commissioner of Buildings.

914. Fees for Permits and Annual Inspection—Indemnifying Bond.) (a) The fee to be charged for permits issued for the erection or construction of billboards or signboards or for the alteration thereof shall be

five dollars for each twenty-five lineal feet of billboard or signboard erected or altered. An annual fee of two dollars for each twenty-five lineal feet of billboard or signboard, or fractional part thereof shall be charged every person, firm or corporation as owner, or in possession, charge or control of any billboard or signboard for inspection of such billboards or signboards; provided, however, that where such signboard does not exceed sixty-five square feet in area and is attached to the surface of a permanent building in accordance with the provisions of Section 903 and is designed to give publicity to the business carried on within such building, and no part of said sign is more than eighteen feet above the average inside grade at the front of the building, no fees for erection or inspection shall be charged; but not more than one sign of sixty-five square feet shall be allowed for each twenty-five lineal feet of frontage, unless the fees for erection and inspection are paid as herein provided for.

(b) Every person, firm or corporation engaged in the business of constructing and erecting billboards or signboards shall file with the City Clerk a bond, with sureties to be approved by the Commissioner of Buildings, in the penal sum of twenty-five thousand (\$25,000.00) dollars, conditioned that such person, firm or corporation shall faithfully comply with all the provisions and requirements of this article with respect to the construction, alteration, location and safety of billboards or signboards and for the payment of the inspection fees required by this article; and conditioned, further, to indemnify, save and keep harmless said City of Chicago and its officials from any and all claims, damages, liabilities, losses, actions, suits or judgments which may be presented, sustained, brought or secured against the City of Chicago or any of its officials on account of the construction, maintenance, alteration or removal of any of said billboards or signboards, or by reason of any accidents caused by or resulting therefrom.

915. Frontage Consents Required.) It shall be unlawful for any person, firm or corporation to erect or construct any billboard or signboard in any block on any public street in which one-half of the buildings on both sides of the street are used exclusively for residence purposes without first obtaining the consent in writing of the owners or duly authorized agents of said owners owning a majority of the frontage of the property on both sides of the street in the block in which such billboard or signboard is to be erected, constructed or located. Such written consents shall be filed with the Commissioner of Buildings before a permit shall be issued for the erection, construction or location of such billboard or signboard.

916. Penalty.) Any person, firm or corporation owning, operating, maintaining or in charge, possession or control of any billboard or signboard within the city, who shall neglect or refuse to comply with the provisions of this article, or who erects, constructs or maintains any billboard or signboard that does not comply with the provisions of this article in all cases where no specific penalty is fixed herein, shall be fined not less than twenty-five (\$25.00) dollars nor more than two hundred (\$200.00) dollars for each offense; and each day on which such person shall permit or allow any billboard or signboard owned, operated, maintained or controlled by him to be erected, constructed or maintained in violation of any of the provisions of this article shall constitute a separate and distinct offense.

917. Fences—Permit Fee.) It shall be unlawful for any person, firm or corporation to erect or construct any fence within the city limits without first obtaining a permit from the Commissioner of Buildings. No wooden

fence shall be constructed of greater height than eight feet above the sidewalk grade or eight feet above the surface of the ground where no grade is established. The fee to be charged for permits for the erection or construction of fences shall be one dollar for each one hundred lineal feet of fence.

918. Fences—Walls—Height of—Wind Resistance.) No wooden fence shall be constructed of greater height than eight feet above the sidewalk grade or eight feet above the surface of the ground where no grade is established. No fence of any other material shall be constructed on a lot alongside a street or alley or within eight feet of such street or alley and parallel thereto of greater height than eight feet above the surface of the street or alley where a grade is established or eight feet above the surface of the street or alley where no grade is established. No single or isolated wall of any material whatever, which forms no part of a building or structure that may be lawfully erected, shall be constructed upon any portion of a lot where the distance from such wall to the lot line is less than the height of the wall, unless such isolated wall shall have lateral supports on at least one side of same with braces extending to the top of the wall and is so constructed that it shall be capable of resisting a horizontal wind pressure on every part of same twice as great as buildings under the provisions of this ordinance must be designed to resist.

In all cases where a fence or wall has been or shall hereafter be erected contrary to the provisions of this section, the Commissioner of Buildings shall forthwith notify the owner or agent of the land on which same is located, or the contractor engaged in erecting same, and shall specify briefly in such notice in what manner such fence or wall violates the provisions of this section, and the said Commissioner of Buildings shall require the person so notified to forthwith make such fence or wall conform to and comply with the provisions of this section, specifying in such notice the time within which such work shall be done.

If at the expiration of the time set forth in the notice provided for in this section, the person so notified shall have refused, neglected or failed to comply with the request made in such notice and shall not have torn down or changed the said fence or wall so as to conform to and comply with the provisions of this section, the Commissioner of Buildings shall have authority and it shall be his duty to proceed forthwith to tear down, or cause to be torn down, such fence or wall or so much thereof as is being maintained or shall have been erected and constructed in violation of the provisions of this section, and the cost of such tearing down shall be charged to and recovered from the owner of such fence or wall or from the person for whom such fence or wall have been or is being erected.

(See Special Ruling VII, Page 298.)

919. Illuminated and Other Roof Signs of Steel Skeleton Construction—Definition—General Requirements—Fees.) (a) Illuminated and other roof signs regulated by this section shall be defined as signs constructed, erected and maintained upon or over the roof of any building which have all or any part of its letters of which said signs may be constructed either in an outline of incandescent lamps or which have painted, flush or raised letters where the face of the sign presents a surface to be affected by wind pressure not in excess of the requirements hereinafter contained; or signs having a border of incandescent lights attached thereto and reflecting light thereon; or transparent glass signs where they are lighted by electricity or other illuminant. Every such sign as hereinabove described shall be constructed with steel skeleton construc-

tion so as to present a surface to be affected by wind pressure which shall not exceed fifty per cent. of the face of the sign. No illuminated roof sign shall be erected or maintained upon or over the roof of any building unless the framework thereof shall be entirely of metal or some other equally incombustible material, and no material, except such material as is used for insulating wires and conductors, which is less combustible than metal, shall be used in, on or about, or comprise a part of any illuminated roof sign, except that the material to which the framework of any such sign shall be anchored, may be substantial beams anchored or securely fastened to the roof or walls of the buildings upon or over which any such sign is erected.

(b) The distance between the roof of said building or structure and the lower edge of such sign shall not be less than five (5) feet. The height of any such sign from the roof of the building or structure to which the same is anchored or attached shall not exceed sixty (60) feet. No such sign, hereafter erected, shall be constructed closer than six (6) feet from the edge of the roof of the building or structure upon which same is erected. No such illuminated roof sign shall be constructed on any building or structure which is over eight stories in height. In case of illuminated roof signs less than twelve (12) feet in height, the permit fees and inspection fees shall be the same as for billboards, and signboards and the provisions for such fees in this section shall not apply. No illuminated roof sign, such as is described in this section, shall be constructed, erected, maintained or put in place until the person, firm or corporation desiring to construct, erect, maintain or put in place such sign shall have made application in writing to the Commissioner of Buildings for permission so to do, submitting with such application plans and specifications showing the size, nature and construction of the sign proposed to be erected, and shall present to the City Electrician plans showing the insulation, location and construction of the electrical part of such sign. If the Commissioner of Buildings shall be of the opinion that such sign, if erected, constructed and maintained in accordance with the plans and specifications so submitted, shall be safe and secure, he shall approve the application so submitted, providing the plans bear the approval of the City Electrician, and the Commissioner of Buildings shall note his approval upon such plans and specifications and keep a copy thereof at all times on file in his office. All signs shall be constructed, erected and maintained of sufficient strength to withstand a wind pressure of not less than thirty pounds per square foot of surface without stressing the material beyond the safe limits of stress given elsewhere in this chapter. It shall be the duty of the Commissioner of Buildings to cause his building inspector or inspectors to make an inspection annually of each illuminated roof sign erected or constructed or being maintained under the provisions of this ordinance for the purpose of ascertaining whether such sign is safely and securely constructed and so anchored and fastened to the building or structure; provided, however, that the provisions of this section shall not apply to the erection, construction and maintenance of signboards and billboards as regulated by the ordinances of the City of Chicago.

(c) Any person, firm or corporation desiring to erect or maintain an illuminated roof sign, as described in this section, shall pay to the city, to cover the cost of inspection and approval by the Commissioner of Buildings of the plans and specifications of such sign, when erected, a fee of seventy-five dollars for the first five hundred square

feet of superficial area of such sign or fractional part thereof, and ten cents for each additional square foot. For each annual inspection of any illuminated roof sign by the Commissioner of Buildings, subsequent to the first inspection, there shall be paid a fee of seventy-five dollars for the first five hundred square feet or fractional part; ten cents additional for each additional square foot area over five hundred square feet. In addition to the fees herein required to be paid for inspection, there shall be paid by the owner or person having charge or control of any illuminated roof sign, as herein described, an annual inspection fee to cover the cost of such inspection, which shall be made by the Commissioner of Gas and Electricity, whose duty it shall be to cause such annual inspection to be made, and such fee shall be at the rate provided by the ordinances of the city.

(d) Every illuminated roof sign erected, constructed or maintained under the provisions of this ordinance shall have the name of the owner thereof placed thereon in a legible and conspicuous manner. No person, firm or corporation shall be permitted to erect or maintain an illuminated roof sign unless he shall execute and file with the City Clerk of Chicago, with sureties to be approved by the Commissioner of Buildings, a bond to the City of Chicago in the penal sum of fifteen thousand dollars (\$15,000.00), conditioned to indemnify, save and keep harmless the City of Chicago, and its officers and agents, from any damage which it, the said city, or any of said officers, may suffer, or from any costs, liability or expense of any kind whatsoever which it, the said city, or any of its officers, may be put to or which may be recovered against the said city, or any of its officers, from or by reason of the construction, erection and maintenance of such sign, and conditional further to faithfully observe and perform all the provisions and conditions of this article and of any ordinance now in force or which may hereafter be passed by the City Council of the City of Chicago, relating to or governing the erection, maintenance, use or inspection of illuminated roof signs.

(e) The permission and authority granted by this article shall cease at any time hereafter at the discretion of the Mayor. In case of the termination of the privileges herein granted by the exercise of the Mayor's discretion as aforesaid, all such electrical signs erected by virtue of the authority conferred by this article, shall be removed at the expense of the owner or owners of the building or the person, firm, corporation or individual who are then maintaining same without any cost or expense of any kind whatsoever to the City of Chicago, provided that in the event of the failure, neglect or refusal on the part of the owner of the building or structure upon which said illuminated electric sign is constructed or the person, firm, corporation or individual operating and maintaining said electric sign to remove said electric sign upon the revocation of the permit by the Mayor as herein provided, the Commissioner of Buildings may proceed to remove same and charge the expense thereof to the owner of the building or structure upon which said illuminated electric sign is constructed or to the person, firm, corporation or individual operating or maintaining same.

(f) Any person, firm or corporation who shall erect, construct or maintain an illuminated roof sign in violation of any of the provisions of this section shall be fined not less than fifty dollars (\$50.00) nor more than two hundred dollars (\$200.00) for each offense.

920. Definition of Word "Block.") Whenever a provision is made in this chapter that frontage consents shall be obtained for the

erection, construction, alteration, enlargement or maintenance of any building or structure in any block, the word "block," so used, shall not be held to mean a square, but shall be held to embrace only that part of a street bounding the square which lies between the two nearest intersecting streets, one on either side of the point at which such building or structure is to be erected, constructed, altered, enlarged or maintained, unless it shall be otherwise specially provided.

ARTICLE XXIV. Frontage Consents.



Fig. 52.

921. Frontage Consents—Where Required—Uses of Property for Required—Consent in Writing.) It shall be unlawful for any person, firm or corporation to locate, build, construct or maintain on any lot fronting on any street or alley in the City in any block in which one-half of the buildings on both sides of the street are used exclusively for residence purposes, or within fifty feet of any such street, any building, structure or place used for a gas reservoir, manufacture of gas, stock yards, slaughter house, packing house, smoke house or place where fish or meats are smoked or cured, soap factory, glue factory, size or gelatine manufactory, renderies, fertilizer manufactory, tannery, storing or scraping of raw hides or skins, lime kiln, cement or plaster of Paris manufactory, oil cloth or linoleum manufactory, rubber manufactory from the crude material, saw or planing mill, wood working establishment, starch factory, glucose or dextrine manufactory, textile factory, laundry run by machinery, factory combined with a foundry, iron or steel works, brass or copper works, sheet metal works, blacksmithing or horseshoeing shop, boiler making, foundry, smelter, metal refinery, machine shop, stone or monument works run by machinery, asphalt manufactory or refining, paint and varnish factory, oil or turpentine factory, printing ink factory, tar distillation or manufactory, tar roofing, tar paper or tarred fabric manufactory, ammonia or chlorine or bleaching powder factory, celluloid manufactory, place for the distillation of wood or bones, lamp black factory, sulphurous acid, sulphuric acid, nitric or hydrochloric acid manufactory, factories or other manufacturing establishments using machinery or emitting offensive or noxious fumes, odors or noises, storage warehouses storing or baling of junk or scrap paper or rags, shoddy manufactory or wool scouring, second-hand store or yard, incineration or reduction of garbage or offal, dead animals or refuse, stable for more than five horses, medical dispensary, livery stable, sale stable, boarding stable, without the written consent of a majority of the property owners according to frontage on both sides of such street or alley. Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction or alteration of any building, structure or place for any of the above purposes: provided, that in determining whether one-half of the buildings on both sides of the street are used exclusively for residence purposes any building fronting

upon another street located upon a corner lot shall not be considered.

922. Reformatories—Sheltering Institutions.) It shall be unlawful for any person, firm or corporation to build, construct, maintain, conduct or manage any reformatory, rescue or sheltering institution in any block or square in which one-half of the buildings on both sides of the street or streets on which the proposed reformatory, rescue or sheltering institution or the grounds thereof may have frontage, are used exclusively for residence purposes without the written consent of a majority of the property owners, according to frontage on both sides of the streets bounding such square. Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction, alteration, or maintenance of such building. Provided, that in determining whether one-half of the buildings on both sides of the street are used exclusively for residence purposes, any building fronting upon another street and located upon a corner lot shall not be considered.

923. Permit For Moving Frame Buildings—Requirements—Written Consents—Space Occupied on lot.) (a) No person, firm or corporation shall be permitted to move any building which has been damaged to an extent greater than 50 per cent of its value by fire, decay or otherwise; nor shall be permitted to move any frame building of such character as is prohibited to be constructed within the fire limits from any point outside the fire limits to any point within the fire limits; nor shall it be permissible to move any building to a location at which the uses for which such building is designed are prohibited by ordinance. Permits for the moving of frame buildings other than those the moving of which is herein prohibited, shall be granted upon the payment of a fee of ten cents for each one thousand cubic feet of volume or fractional part thereof of such building, and securing and filing the written consent of two-thirds of the property owners according to frontage on both sides of the street in the block in which such building is to be moved. No permit shall be issued to move any building used or designed to be used for purposes for which frontage consents are required until frontage consents in the block to which such building is to be moved have also been secured and filed as required by the ordinances relating to such use.

(b) No building used for residence or tenement house purposes shall be moved from one lot to another or from one location to another upon the same lot unless the space to be occupied on such lot shall comply with the provisions of Section 642 of this chapter.

(c) No frontage consent shall be required of any person, firm or corporation for removing a building upon his own premises and not going upon the premises of any other person, or upon any street, alley or other public place, in making such removal.

924. Amusements—Frontage Consents Required.) It shall be unlawful for any person, firm or corporation to construct or erect any building or structure designed or intended to be used for the purpose of presenting or carrying on therein any entertainment for which a license is required by the ordinances of the City of Chicago or to devote any grounds or place to such purposes without first obtaining the written consent of the property owners as required by the City ordinances.

925. Buildings for the Storage of Shavings, Sawdust and Excelsior—Frontage Consents.) It shall be unlawful for any person, firm or corporation to construct or erect any building designed or intended to be used for the purpose of storing shavings, sawdust or excelsior therein within the city without

first obtaining the written consent of the property owners as required by the City ordinances.

926. Frontage Consents — Business of Selling Provisions, Etc., in Residence Districts.) It shall be unlawful for any person, firm or corporation to carry on the business of selling meats, poultry, fish, butter, cheese, lard, vegetables or any other provisions from any place of business located in any block in which all the other buildings are used exclusively for residence purposes, without first securing and filing with the City Collector the written consent of three-fourth of the property owners according to frontage on both sides of the street in the block in which the building to be thus used is located, provided in determining whether all the buildings in said block are used exclusively for residence purposes, any building fronting on another street and located upon a corner shall not be considered. In case a permit for building a store for such purposes in such block, or converting a building to store purposes in such block is applied for, the frontage consents required by this section shall be filed with the Commissioner of Buildings.

927. Business of a Store—Requirements as to a Permit for Erection.) No permit shall be issued for the erection or remodeling of any building in any block in which the use of buildings is restricted or regulated by ordinance if such building is designed to be used for conducting therein any business or store, without first requiring the applicant for such permit to file with the Commissioner of Buildings a plat showing the use to which all the property in such block is devoted.

928. Withholding of Building Permit—Protest of Property Owners—Public Hearing—Definition of Word "Square".) In all cases where an application for a permit is made for the erection of a new building in any square in which a majority of the buildings are used exclusively for residence purposes, or in a square on the opposite side of the street from such square so used for residential purposes; if there shall be filed with the Commissioner of Buildings a protest signed by not less than ten owners of property in such square so used for residential purposes, or in case the ownership of the frontage is in less than twenty persons then by a majority of the owners according to frontage, the Commissioner of Buildings shall withhold the issuance of the permit until the City Council shall have ordered a public hearing similar to that required in an act of the general assembly entitled "An Act to confer certain additional powers upon city councils in cities and presidents and boards of trustees in villages and incorporated towns concerning buildings and structures, the intensity of use of lot areas, the classification of trades, industries, buildings and structures with respect to location and regulations, the creation of districts of different classes, and the establishment of regulations and restrictions applicable thereto," in force June 28, 1921. For the purposes of this section a square shall be understood to be a plot of ground containing city lots surrounded by public streets, railway right of way, natural boundaries, or public places or thoroughfares.

929. Garages — Frontage Consents Required.) No person, firm or corporation shall keep, conduct or operate a garage in this city without first obtaining a license so to do in the manner provided for in this ordinance; and it shall not be lawful for any person, firm or corporation to locate, build, construct or maintain any garage within the territory bounded by the Chicago River and the south branch thereof on the north and west, by Lake Michigan on the east and by Van Buren Street on the south, any part of which is within eighty feet, or the entrance or exit to or from which, for the use of au-

tomobiles, is within one hundred and sixty feet of any portion of the street front of any building used as and for a hospital, church or public or parochial school, or such entrance or exit of which is upon a street containing street car tracks and within one block of the entrance of a street railway tunnel, or which shall house within said distance of one hundred and sixty feet of such street front, more than seventy-five cars. It shall not be lawful to locate, build, construct or maintain any garage within two hundred feet of any building used as and for a hospital, church or public or parochial school or the grounds thereof, in any portion of the City of Chicago outside of the territory above named, nor shall any person, firm or corporation locate, build, construct or maintain any garage in the city, on any lot in any block in which two-thirds of the buildings on both sides of the street are used exclusively for residence purposes, or within one hundred feet of such street in any such block without the written consent of a majority of the property owners according to frontage on both sides of the street; provided, that all lots which abut only on a public alley or court shall be considered as fronting on the street to which such alley or court leads. Such written consents shall be obtained and filed with the commissioner of buildings before a permit is issued for the construction of any building; provided, that in determining whether two-thirds of the buildings on both sides of such street are used exclusively for residence purposes, any building fronting upon another street and located upon a corner lot shall not be considered; and provided, further, that the word "block" as used in this section, shall not be held to mean a square but shall be held to embrace only that part of the street in question which lies between the two nearest intersecting streets.

930. Hospital or Home frontage consents.) It shall be unlawful for any person, firm, association or corporation to build, construct, maintain, conduct or manage a hospital, or a home, as defined in chapter XXXIX of this ordinance, in any block in which two-thirds of the buildings fronting on both sides of the street or streets on or along which the proposed hospital or home may face are devoted exclusively to residence purposes, unless the owners of a majority of the frontage in such block and the owners of a majority of the frontage on the opposite side or sides of the street or streets on or along which said building faces consent in writing to the building, construction or maintaining, managing or conducting of any such hospital or home in such block; provided, however, that no new frontage consents shall be required if such hospital or home has heretofore been licensed by the city of Chicago as a hospital, home or nursery at the present location. Such written consents of the majority of said property owners shall be filed with the commissioner of health before a permit shall be granted for the building or construction of any such hospital or home, and before a license shall be issued for the maintaining, conducting or managing of any such hospital or home.

931. Undertaking establishment frontage consents.) It shall be unlawful for any person, firm or corporation to establish or maintain a morgue or to carry on the business of an undertaker, as defined in chapter XXXIX of this ordinance, that receives in connection with such business, at his, their or its place of business, the body of any dead person for embalming or other purposes, on or along any boulevard or pleasure driveway, without the written consent of a majority of the property owners according to the frontage on both sides of such boulevard or pleasure driveway in the block in which such morgue or place of business is located; it shall also be unlawful for any person, firm or corporation to establish or maintain a morgue or to carry on the busi-

ness of an undertaker, as defined in chapter XXXIX of this ordinance, that receives, in connection with such business, at his, their or its place of business, the body of any dead person for embalming or other purposes, on or along any street in any block in which two-thirds of the buildings on both sides of the street are used exclusively for residence purposes, without the written consent of a majority of the property owners according to the frontage on both sides of such street in such block; provided that nothing herein contained shall apply to such location in the case of any person licensed as an undertaker and authorized to carry on such business at any such location at the time of the passage of this ordinance nor to any block in any street on which street cars are operated. Such frontage consents shall be obtained and filed with the department of health before a license shall issue for such business.

932. **Ice Plant Frontage Consents.)** It shall be unlawful for any person, firm or corporation to locate, establish, conduct or maintain any ice-making house or cooling plant, or any buildings used for the storage of ice, in any block in which two-thirds of the buildings fronting on both sides of the street on which the proposed plant shall be located are devoted exclusively to residence purposes, unless the owners of the majority of the frontage in said block on both sides of the street on which said plant is located shall consent in writing to the location, establishment, conducting or maintenance of such plant in such block. Such written consents of the majority of said property owners shall be filed with the Commissioner of Buildings before a permit shall be granted for the building or construction of any such ice-making house or cooling plant. Any person, firm or corporation violating any of the provisions of the section, or refusing, failing or neglecting to comply with any of the said provisions, shall be fined not less than five dollars nor more than one hundred dollars for each offense, and a separate offense shall be regarded as having been committed for each day during which such violation shall continue.

933. **Frontage consents—general requirements.)** Whenever frontage consents are required, for the construction of a building or for any occupation for which a building is about to be constructed or altered, under any section of this ordinance or under any other ordinance of the city, such frontage consents shall be presented to the commissioner of buildings before the issuance of a permit for the erection or alteration of a building for such purpose. Unless otherwise specified the provisions of this chapter in such case shall apply as to the definition of the word "block," whenever such word is used in provisions requiring frontage consents.

Note: The whole of Article XXIV A—**Ventilation**—was repealed January 5, 1929, pp. 4244 to 4246, and the work thereunder transferred to the Health Department, and designated as Chapter XXXIX, Article XXXV, Sections 2152, 2153 and 2154, of the Code of 1922.

ARTICLE XXV. Fire Limits.

934. **Fire limits and provisional fire limits.)** (a) The fire limits of the city of Chicago within which wooden buildings shall not be erected, shall be and they are hereby defined as follows: all that part of the city of Chicago bounded by the following limits: beginning at the intersection of the shore of Lake Michigan and the center line of Rogers avenue, thence southwesterly along the center line of Rogers avenue to the east line of the right of way of the Chicago and North Western Railway Company, then south along the east line of said right of way of the Chicago and North Western Railway Company to a line 125 feet north of the

north line of Foster avenue, thence west along said line 125 feet north of the north line of Foster avenue to the center line of the North Shore channel, thence southeasterly along the center line of said North Shore channel to the center line of the North branch of the Chicago river, thence northwesterly and westerly along the center line of said North branch of the Chicago river to a line 125 feet west of the west line of north Kedzie avenue, thence south along said line 125 feet west of the west line of north Kedzie avenue, to a line 125 feet south of the south line of Irving Park boulevard, thence east along said line 125 feet south of the south line of Irving Park boulevard to the center line of the north branch of the Chicago river, thence northerly along the center line of the north branch of the Chicago river to the center line of Berteau avenue, thence east along the center line of Berteau avenue to a line 125 feet west of the west line of north Western avenue, thence south along said line 125 feet west of the west line of north Western avenue to the center line of Addison street, thence east along the center line of Addison street to the center line of north Western avenue, thence south along the center line of north Western avenue to the center line of Belmont avenue, thence east along the center line of Belmont avenue to the center line of Southport avenue, thence south along the center line of Southport avenue to the center line of Fullerton avenue, thence west along the center line of Fullerton avenue to the center line of the North Branch of the Chicago river, thence northwesterly along the center line of the North Branch of the Chicago river to a line 125 feet north of the north line of Belmont avenue thence west along said line 125 feet north of the north line of Belmont avenue to a line 125 feet west of the west line of north Kostner avenue, thence south along said line 125 feet west of the west line of north Kostner avenue to a line 125 feet north of the north line of Diversey avenue, thence west along said line 125 feet north of the north line of Diversey avenue, to a line 125 feet west of the west line of north Cicero avenue, thence south along said line 125 feet west of the west line of north Cicero avenue to the center line of west Fullerton avenue, thence west along the center line of Fullerton avenue to the center line of north Laramie avenue, thence south along the center line of north Laramie avenue to a line 125 feet northeasterly of the northeasterly line of west Grand avenue, thence northwesterly along said line 125 feet northeasterly of the northeasterly line of west Grand avenue to the center line of Harlem avenue, thence south along the center line of Harlem avenue to a line 125 feet southwesterly of the southwesterly line of west Grand avenue, thence southeasterly along said line 125 feet southwesterly of the southwesterly line of west Grand avenue to a line 125 feet south of the south line of Armitage avenue, thence east along said line 125 feet south of the south line of Armitage avenue to a line 125 feet southwesterly of the southwesterly line of west Grand avenue, thence southeasterly along said line 125 feet southwesterly of the southwesterly line of west Grand avenue to the southerly line of the right of way of the Chicago, Milwaukee and St. Paul Railway Company, thence northwesterly and westerly along the southerly line of the said right of way of the Chicago, Milwaukee & St. Paul Railway Company to the center line of Narragansett avenue, thence south along the center line of Narragansett avenue to the center line of west North avenue, thence east along the center line of west North avenue to the center line of north Austin avenue, thence south along the center line of north Austin avenue to the center line of west Roosevelt road, thence east along the center line of west Roosevelt road to the

center line of south Kenton avenue produced north, thence south along the center line of south Kenton avenue produced north and the center line of south Kenton avenue to the center line of west 39th street produced west, thence east along the center line of west 39th street produced west to the center line of the Illinois and Michigan canal, thence northeasterly along the center line of the Illinois and Michigan canal to the center line of south Western avenue boulevard, thence south along the center line of south Western avenue boulevard to the center line of west 39th street, thence east along the center line of west 39th street to the center line of south Robey street, thence south along the center line of south Robey street to the center line of west 43rd street, thence east along the center line of west 43rd street to a line 125 feet west of the west line of south Ashland avenue, thence north along said line 125 feet west of the west line of south Ashland avenue to the center line of west 41st street, thence east along the center line of west 41st street to the center line of south Ashland avenue, thence north along the center line of south Ashland avenue to the center line of west 40th street, thence east along the center line of west 40th street to a line 125 feet east of the east line of south Ashland avenue thence south along said line 125 feet east of the east line of south Ashland avenue to the center line of west 43rd street, thence west along the center line of west 43rd street to the center line of south Ashland avenue, thence south along the center line of south Ashland avenue to the center line of west 47th street, thence east along the center line of west 47th street to a line 125 feet west of the west line of south Halsted street, thence south along said line 125 feet west of the west line of south Halsted street to the center line of west 51st street, thence west along the center line of west 51st street to the center line of south Racine avenue, thence south along the center line of south Racine avenue to a line 125 feet north of the north line of west 63rd street, thence west along said line 125 feet north of the north line of west 63rd street to the center line of south Western avenue, thence north along the center line of south Western avenue and south Western avenue boulevard to the center line of west 45th street, thence west along the center line of west 45th street and west 45th street produced west to the center line of south Cicero avenue, thence south along the center line of south Cicero avenue to the center line of west 51st street, thence west along the center line of west 51st street to the southerly line of the right of way of the Chicago and Alton Railroad and thence southwesterly along said southerly line of the right of way of the Chicago and Alton Railroad to the center line of south Harlem avenue, thence south along the center line of south Harlem avenue to the center line of west 59th street, thence east along the center line of west 59th street to the center line of south Narragansett avenue, thence south along the center line of south Narragansett avenue and Narragansett avenue produced south to the center line of west 65th street produced west, thence east along the center line of west 65th street produced west and west 65th street to the center line of south Cicero avenue, thence south along the center line of south Cicero avenue to the center line of west 69th street produced west, thence east along the center line of west 69th street produced west and west 69th street to the center line of south Western avenue, thence north along the center line of south Western avenue to a line 125 feet south of the south line of west 63rd street, thence east along the said line 125 feet south of the south line of west 63rd street to the center line of south Racine avenue, thence south along the center line of south Racine avenue to the center line of west 75th street, thence

west along the center line of west 75th street to a line 125 feet east of the east line of south Ashland avenue, thence north along said line 125 feet east of the east line of south Ashland avenue to the center line of west 71st street, thence west along the center line of west 71st street to a line 125 feet west of the west line of South Ashland avenue, thence south along said line 125 feet west of the west line of south Ashland avenue to the center line of west 75th street, thence west along the center line of west 75th street and west 75th street produced to the center line of south Cicero avenue, thence south along the center line of south Cicero avenue to the center line of west 87th street, thence east along the center line of west 87th street to the center line of south Western avenue, thence south along the center line of south Western avenue to the center line of west 99th street, thence west along the center line of west 99th street to the center line of south California avenue, thence south along the center line of south California avenue to the center line of west 115th street, thence east along the center line of west 115th street to the center line of south Western avenue, thence south along the center line of south Western avenue to the center line of west 119th street, thence east along the center line of west 119th street to the center line of Vincennes avenue, thence northeasterly along the center line of Vincennes avenue to the center line of west 103rd street, thence east along the center line of west 103rd street to the center line of south Halsted street, thence north along the center line of south Halsted street to a line 125 feet south of the south line of west 95th street, thence east along said line 125 feet south of the south line of west 95th street to the center line of Eggleston avenue, thence north along the center line of Eggleston avenue and Eggleston avenue produced north to a line 125 feet south of the south line of west 83rd street, thence east along said line 125 feet south of the south line of west 83rd street to a line 125 feet east of the east line of Stewart avenue, thence south along said line 125 feet east of the east line of Stewart avenue and Stewart avenue produced south to a line 125 feet north of the north line of west 95th street, thence east along said line 125 feet north of the north line of west 95th street to a line 125 feet west of the west line of south State street, thence south along said line 125 feet west of the west line of south State street to a line 125 feet south of the south line of west 99th street, thence east along a line 125 feet south of the south line of west and east 99th street to a line 125 feet west of the west line of south Michigan avenue, thence south along said line 125 feet west of the west line of south Michigan avenue to a line 125 feet north of the north line of east and west 119th street, thence west along a line 125 feet north of the north line of east and west 119th street to a line 125 feet west of the west line of south Morgan street, thence south along said line 125 feet west of the west line of south Morgan street to a line 125 feet south of the south line of west 119th street, thence east along a line 125 feet south of the south line of west and east 119th street to a line 125 feet east of the east line of south Michigan avenue, thence north along said line 125 feet east of the east line of south Michigan avenue to a line 125 feet south of the south line of east 99th street, thence east along said line 125 feet south of the south line of east 99th street to a line 125 feet west of the west line of South Park avenue, thence south along said line 125 feet west of the west line of South Park avenue to the center line of east 115th street, thence east along the center line of east 115th street to the northeasterly line of the right of way of the Michigan Central Railroad Company, thence south and southeasterly along said northeasterly line of the

right of way of the Michigan Central Railroad Company to the center line of east 127th street, thence east along the center line of east 127th street to the shore line of Lake Calumet, thence northwesterly and northeasterly along the shore line of said Lake Calumet to a line 125 feet east of the east line of Stony Island avenue, thence north along said line 125 feet east of the east line of Stony Island avenue to a line 125 feet north of the north line of east 95th street, thence west along said line 125 feet north of the north line of east 95th street to a line 125 feet east of the east line of the right of way of the Illinois Central Railroad Company, thence northeasterly along said line 125 feet east of the east line of the right of way of the Illinois Central Railroad Company to the center line of east 83rd street, thence east along the center line of east 83rd street to the east line of the right of way of the New York, Chicago and St. Louis Railroad, thence south and southeast along said east line of the right of way of the New York, Chicago and St. Louis Railroad to the center line of east 87th street, thence east along the center line of east 87th street to the center line of Jeffery avenue, thence north along the center line of Jeffery avenue to the southwest line of the right of way of the Lake Shore and Michigan Southern Railway, thence southeast along said southwest line of the right of way of the Lake Shore and Michigan Southern Railway to a line 125 feet west of the west line of Yates avenue, thence north along said line 125 feet west of the west line of Yates avenue to a line 125 feet south of the south line of east 83rd street, thence east along said line 125 feet south of the south line of east 83rd street to the center line of Yates avenue, thence north along the center line of Yates avenue to a line 125 feet south of the south line of east 79th street, thence east along said line 125 feet south of the south line of east 79th street to the center line of Brandon avenue, thence south along the center line of Brandon avenue to the center line of east 83rd street, thence east along the center line of east 83rd street to the center line of Burley avenue, thence south along the center line of Burley avenue, to the center line of east 89th street, thence west along the center line of east 89th street to a line 125 feet west of the west line of Manistee avenue, thence south along said line 125 feet west of the west line of Manistee avenue to the northeasterly line of the right of way of the Lake Shore and Michigan Southern Railway, thence southeasterly along said northeasterly line of the right of way of the Lake Shore and Michigan Southern Railway to the easterly and southeasterly line of the South Chicago branch of the Pittsburgh, Ft. Wayne and Chicago Railroad Company, thence southwesterly along said easterly and southeasterly line of the South Chicago branch of the Pittsburgh, Ft. Wayne and Chicago Railroad Company to the center line of east 106th street, thence east along the south line of east 106th street to a line 200 feet east of the east bank of the Calumet river, thence northerly along said line 200 feet east of the east bank of the Calumet river to the center line of east 95th street, thence east along the center line of east 95th street to the shore of Lake Michigan, thence northerly and northwesterly along the shore of Lake Michigan to the place of beginning.

All that part of the City of Chicago bounded by the following limits is hereby included within the fire limits of the City of Chicago: Commencing at the intersection of the center line of West 95th street and South Ashland avenue thence west along the center line of West 95th street to the right of way of the suburban branch of the Chicago, Rock Island and Pacific Railroad Company, thence north along the right of

way of the suburban branch of the Chicago, Rock Island and Pacific Railroad Company to the center line of West 90th street, thence east along the center line of East 90th street to its intersection with the center line of South Ashland avenue, thence south along the center line of South Ashland avenue to the intersection of the center line of West 95th street or the place of beginning.

(b) Also beginning at the intersection of the center line of Addison street and the center line of the North Branch of the Chicago river, thence west along the center line of Addison street to the center line of north Whipple street, thence south along the center line of north Whipple street to the center line of Elston avenue, thence southeasterly along the center line of Elston avenue to the center line of Roscoe street, thence east along the center line of Roscoe street to the center line of the North Branch of the Chicago River, thence north along the center line of the North Branch of the Chicago river to the place of the beginning.

Also beginning at the intersection of the east line of the right of way of the Chicago & Northwestern Railway Company and a line 125 feet north of the north line of Foster avenue; thence west along said line 125 feet north of the north line of Foster avenue to the center line of the North Shore Channel of the Sanitary District Canal; thence northwesterly along the center line of said North Shore Channel to the center line of Devon avenue; thence east along the center line of Devon avenue to the center line of North Kedzie avenue produced north; thence North along the center line of North Kedzie avenue produced north to the center line of Howard street produced west; then east along said center line of Howard street produced west and Howard street to the east line of the right of way of the Chicago & Northwestern Railway; thence southeasterly and southerly along the said east line of the right of way of the Chicago & Northwestern Railway to the place of beginning.

Also beginning at the intersection of West 69th street and South California avenue; thence south along the center line of South California avenue to the center line of West 75th street; thence east along the center line of West 75th street to the center line of Irving avenue; thence north along the center line of Irving avenue to the center line of West 69th street; thence west along the center line of West 69th street to the place of beginning.

Also, beginning at the intersection of the center line of North Harlem avenue and Addison street, thence east along Addison street to the center line of North Tripp avenue; thence north along the center line of North Tripp avenue to the center line of Montrose avenue; thence east along the center line of Montrose avenue to the center line of North Crawford avenue; thence north along the center line of North Crawford avenue to the North Branch of the Chicago River; thence northwesterly along the North Branch of the Chicago River to the center line of Bryn Mawr avenue; thence west along the center line of Bryn Mawr avenue to the center line of North Austin avenue; thence south along the center line of North Austin avenue to the center line of Irving Park boulevard; thence west along the center line of Irving Park Boulevard to the center line of North Harlem avenue; thence south along the center line of North Harlem avenue to the place of beginning.

Amendment of May 7, 1924, and further amended (June 18, 1924) to take effect on January 1, 1925; further amended to take effect July 1, 1925, and further amended to take effect January 1, 1926.

Also commencing at the intersection of the center line of East 67th street with the center line of South Park avenue, thence west along the center line of East 67th street to its intersection with the center line of South State street, thence south along the center line of South State street to its intersection with the center line of East 75th street,

thence east along the center line of East 75th street to its intersection with the center line of South Park avenue; thence north along the center line of South Park avenue to the place of beginning.

Also commencing at the intersection of the center line of West 83rd street and the easterly line of the right of way of the Chicago, St. Louis and Pittsburgh Railroad Company; thence southeasterly along said easterly line to its intersection with the center line of West 90th street; thence east along the center line of West 90th street to its intersection with the center line of South Winchester avenue; thence northerly along the center line of South Winchester avenue to its intersection with the center line of West 83rd street; and thence west along the center line of West 83rd street to the place of beginning.

Also beginning at the intersection of East 87th street and Stony Island avenue; thence south along the center line of Stony Island avenue to the center line of East 91st street; thence east along the center line of East 91st street to the center line of Colfax avenue; thence north along the center line of Colfax avenue to the right of way of the Pennsylvania Railroad; thence northwesterly along the right of way of the Pennsylvania Railroad to the center line of East 87th street; thence west along the center line of East 87th street to the place of beginning.

Beginning at the intersection of a line 125 feet south of the south line of West 95th street and the center line of Vincennes avenue; thence west along said line 125 feet south of the south line of West 95th street to the center line of Beverly avenue; thence southeasterly along the center line of Beverly avenue to the center line of Vincennes avenue; thence northeasterly along the center line of Vincennes avenue to the place of beginning.

Also beginning at the intersection of East 106th street and State Line road; thence west along the center line of East 106th street to the right of way of the South Chicago and Southern Railroad; thence south along the right of way of the South Chicago and Southern Railroad to the center line of East 108th street; thence west along the center line of East 108th street to the center line of Avenue G; thence south along the center line of Avenue G to the center line of East 110th street; thence west along the center line of East 110th street to the center line of Avenue O; thence south along the center line of Avenue O to the center line of East 114th street; thence east along the center line of East 114th street to the right of way of the South Chicago and Southern Railroad; thence north along the right of way of the South Chicago and Southern Railroad to the center line of East 112th street; thence east along the center line of East 112th street to the Illinois and Indiana State line; thence north along the Illinois and Indiana State line to the place of beginning.

Also, beginning at the intersection of the center line of North Harlem avenue and Addison street thence east along Addison street to a line 125 feet east of the east line of North Cicero avenue; thence south along said line 125 feet east of the east line of North Cicero avenue to a line 125 feet north of the north line of Diversey avenue; thence west along said line 125 feet north of the north line of Diversey avenue to a line 125 feet west of the west line of North Cicero avenue; thence south along the said line 125 feet west of the west line of North Cicero avenue to a line 125 feet south of the south line of West Diversey avenue; thence west along the said line 125 feet south of the south line of West Diversey avenue to the center line of North Harlem avenue; thence north along the center line of North Harlem avenue to the place of beginning.

Also beginning at the intersection of West Garfield boulevard and South Racine avenue; thence west along the center line of West Garfield boulevard to the center line of South Wood street; thence south along the center

line of South Wood street to the center line of West 66th street; thence east along the center line of West 66th street to the center line of Loomis boulevard; thence north along the center line of Loomis boulevard to the center line of West 63rd street; thence east along the center line of West 63rd street to the center line of South Racine avenue; thence north along center line of South Racine avenue to the place of beginning.

Also beginning at the intersection of West 49th street and Loomis street; thence west along the center line of West 49th street to the center line of South Western avenue; thence south along the center line of South Western avenue to a line 125 feet north of the north line of West 63rd street; thence east along said line 125 feet north of the north line of West 63rd street to the center line of South Wood street; thence north along the center line of South Wood street to the center line of West Garfield boulevard; thence east along the center line of West Garfield boulevard to the center line of Loomis street; thence north along the center line of Loomis street to the place of beginning.

Also beginning at the intersection of a line 125 feet south of the south line of West 63rd street, and the center line of South Wood street; thence west along said line 125 feet south of the south line of West 63rd street to the center line of South Western avenue; thence south along the center line of South Western avenue to the center line of West 69th street; thence east along the center line of West 69th street to the center line of South Wood street; thence north along the center line of South Wood street to the place of beginning.

Also beginning at the intersection of West 59th street and South Narragansett avenue; thence west along the center line of West 59th street to the center line of South Harlem avenue; thence south along the center line of South Harlem avenue to the center line of West 65th street; thence east along the center line of West 65th street to the center line of South Narragansett avenue; thence north along the center line of South Narragansett avenue to the place of beginning.

Also beginning at the intersection of the center line of East 89th street with the center line of Stony Island avenue; thence north along the center line of Stony Island avenue to its intersection with the center line of East 87th street; thence east along the center line of East 87th street to its intersection with the center line of Jeffery avenue; thence south along the center line of Jeffery avenue to its intersection with the center line of East 89th street; thence west along the center line of East 89th street to the place of beginning.

Also beginning at the intersection of West 106th street and South Halsted street; thence west along the center line of West 106th street to the center line of the alley first west of South Peoria street; thence north along the center line of said alley to the center line of West 103rd street; thence east along the center line of West 103rd street to its intersection with the center line of South Halsted street; thence south along the center line of South Halsted street to the place of beginning.

Also, all the territory lying between lines 125 feet on either side of and parallel to the following streets: East and West 103rd street between Indiana avenue and South Halsted street; East 107th street between Indiana avenue and South State street; and Wentworth avenue between West 99th street and West 119th street.

Note: The following paragraph is contained in an ordinance passed June 20, 1928:

"The territory adjoining both sides of Wentworth avenue between West 99th street and West 103rd street is hereby excluded from the fire-limit area of the City of Chicago."

Also beginning at the intersection of Peterson avenue and the North Shore Channel

of the Sanitary District of Chicago; thence west along the center line of Peterson avenue to the center line of North Central Park avenue; thence south along the center line of North Central Park avenue to the center line of Bryn Mawr avenue; thence east along the center line of Bryn Mawr avenue to the center line of the North Shore Channel of the Sanitary District of Chicago; thence north along the center line of the North Shore Channel of the Sanitary District of Chicago to the place of beginning.

Also beginning at the intersection of West 103rd street and South Halsted street; thence west along the center line of West 103rd street to the center line of Vincennes avenue; thence southwesterly along the center line of Vincennes avenue to the center line of West 107th street; thence east along the center line of West 107th street to the center line of South Halsted street; thence north along the center line of South Halsted street to the place of beginning.

Also beginning at the intersection of West 107th street and South Halsted street; thence west along the center line of West 107 street to the present fire limit line just east of Vincennes avenue; thence generally in a southwesterly direction along the said present fire limit line lying along and just east of said Vincennes avenue to the center line of West 119th street; thence east along the center line of West 119th street to its intersection with the center line of South Halsted street; thence north along the center line of South Halsted street to the place of beginning.

Also beginning at the intersection of West 103rd street and Stewart avenue; thence south along the center line of Stewart avenue to the center line of West 111th street; thence west along the center line of West 111th street to the center line of South Halsted street; thence north along the center line of South Halsted street to the center line of West 103rd street; thence east along the center line of West 103rd street to the place of beginning.

Also beginning at the intersection of South Michigan avenue and East 119th street; thence south along the center line of South Michigan avenue to the center line of East 127th street.

Also beginning at the intersection of West 69th street and South California avenue; thence west along the center line of West 69th street to the center line of South Cicero avenue; thence south along the center line of South Cicero avenue to West 75th street; thence east along the center line of West 75th street to South California avenue; thence north along the center line of South California avenue to the place of beginning.

Beginning at the intersection of the center lines of South Halsted street and West 99th street, thence running east on the center line of West 99th street to the right of way of the Chicago & Western Indiana Railroad, thence south on said right of way line to the center line of West 103rd street, thence west on the center line of West 103rd street to the center line of South Halsted street, thence north on the center line of South Halsted street to the place of beginning.

Passed Sept. 12, 1928.

Also beginning at the intersection of West 127th street and South Peoria street; thence west along the center line of West 127th street to the western city limits; thence south along the western city limits line to the north line of the Little Calumet River; thence east along the north line of the Little Calumet River to the center line of South Peoria street; thence north along the center line of South Peoria street to the place of beginning.

Passed Oct. 31, 1928.

Also all territory lying between the center lines of the following streets as boundaries; beginning at the intersection of the center line of East 99th street and the center line of Indiana avenue, thence south along the center line of Indiana avenue to the center

line of Kensington avenue, thence east along the center line of Kensington avenue to the center line of Cottage Grove avenue, thence northeast along the center line of Cottage Grove avenue to the center line of East 99th street, thence west along the center line of East 99th street to the center line of Indiana avenue.

Passed Nov. 21, 1928.

Also the west side of Indiana avenue from East 99th street to East 103rd street.

Passed December 12, 1928.

Also beginning at the intersection of East 110th street and Avenue M; thence east along the center line of 110th street to the center line of Avenue G; thence north along the center line of Avenue G to the center line of East 108th street; thence east along the center line of East 108th street to the South Chicago and Southern Railway; thence north along the South Chicago and Southern Railway to the center line of East 106th street; thence west along the center line of East 106th street to the center line of Avenue M; thence south along the center line of Avenue M to the place of beginning.

Passed December 19, 1928.

Also beginning at the intersection of West 99th street and Princeton avenue; thence south along the east side of Princeton avenue to the center line of West 103rd street; thence west along the center line of West 103rd street to the right of way of the Chicago and Western Indiana Railroad tracks; thence north along the right of way of said railroad tracks to the center line of West 99th street; thence east along the center line of West 99th street to the place of beginning.

Passed March 18, 1929.

Also beginning at the intersection of West 95th street and South Halsted street; thence south along the center line of South Halsted street to the center line of West 99th street; thence east along the center line of West 99th street to the center line of Eggleston avenue; thence north along the center line of Eggleston avenue to the center line of West 95th street and thence west along the center line of West 95th street to the place of beginning.

Passed March 30, 1929.

Also beginning at the intersection of the center line of Belmont avenue and the center line of the North Branch of the Chicago River; thence north along the center line of the North Branch of the Chicago River to the center line of Roscoe street; thence west along the center line of Roscoe street to the center line of Elston avenue; thence northwest along the center line of Elston avenue to the center line of North Whipple street; thence north along the center line of North Whipple street to the center line of Addison street; thence east along the center line of Addison street to the center line of the North Branch of the Chicago River; thence north along the center line of the North Branch of the Chicago River to a line 125 feet south of the south line of Irving Park boulevard; thence west along said line 125 feet south of the south line of Irving Park boulevard to a line 125 feet west of the west line of North Kedzie avenue; thence north along said line 125 feet west of the west line of North Kedzie avenue to the center line of the North Branch of the Chicago River; thence east and southeasterly along the center line of said North Branch of the Chicago River to the center line of the North Shore Channel; thence northwesterly along the center line of said North Shore Channel to the center line of Bryn Mawr avenue; thence west along the center line of Bryn Mawr avenue to the center line of North Central Park avenue; thence north along the center line of North Central Park avenue to the center line of Peterson avenue; thence east along the center line of Peterson avenue to the center line of the North Shore Channel; thence northwesterly along the center line of said North

Shore Channel to the center line of Devon avenue; thence west along the center line of Devon avenue to the center line of North Crawford avenue; thence south along the center line of North Crawford avenue to the center line of Montrose avenue; thence west along the center line of Montrose avenue to the center line of North Tripp avenue; thence south along the center line of North Tripp avenue to the center line of Addison street; thence east along the center line of Addison street to the center line of North Kedzie avenue; thence south along the center line of North Kedzie avenue to the center line of Belmont avenue; thence east along the center line of Belmont avenue to the center line of the North Branch of the Chicago River.

Passed October 24, 1929.

EXCLUSION of certain territory from the fire-limit area.

Exclusion of certain territory from the fire-limit area.

The territory adjoining both sides of West 102nd street between Princeton avenue and the Chicago and Western Indiana Railroad is hereby excluded from the fire-limit area of the City of Chicago.

Passed April 22, 1929.

The territory adjoining both sides of South Peoria street between West 117th street and West 118 street and West 118th street is hereby excluded from the fire-limit area of the City of Chicago.

Passed June 14, 1929.

Normal avenue from West 111th street to West 112th street is hereby excluded from the fire-limit area of the City of Chicago.

Passed March 19, 1930.

(c) Excepting the district bounded as follows: beginning at the intersection of a line 125 feet south of the south line of Foster avenue and the center line of north Leavitt street, thence west along said line 125 feet south of the south line of Foster avenue to a line 125 feet east of the east line of north Western avenue, thence south along said line 125 feet east of the east line of north Western avenue to a line 125 feet east of the east line of Lincoln avenue, thence southeasterly along said line 125 feet east of the east line of Lincoln avenue, thence southeasterly along said line 125 feet east of the east line of Lincoln avenue to a line 125 feet north of the north line of Lawrence avenue, thence east along said line 125 feet north of the north line of Lawrence avenue to the center line of north Leavitt street, thence north along the center line of north Leavitt street to the place of beginning.

(d) Excepting also the district bounded as follows: beginning at the intersection of a line 125 feet south of the south line of Belmont avenue and the center line of north Kedzie avenue, thence west along said line 125 feet south of the south line of Belmont avenue to the center line of north Crawford avenue, thence south along the center line of north Crawford avenue to the center line of north Fullerton avenue, thence east along the center line of Fullerton avenue to the center line of north Central Park avenue, thence north along the center line of north Central Park avenue to the center line of Diversey avenue, thence east along the center line of Diversey avenue to the center line of north Kedzie avenue, thence north along the center line of north Kedzie avenue to the place of beginning.

(e) Excepting also the district bounded as follows: beginning at the intersection of a line 125 feet south of the south line of west Division street and the center line of north Laramie avenue, thence west along said line 125 feet south of the south line of west Division street to the center line of north Central avenue, thence south along the center line of north Central avenue to the center line of west Chicago avenue, thence east along the center line of west Chicago avenue to the center line of north Laramie avenue, thence north along the center line

of north Laramie avenue to the place of beginning.

(f) Excepting also the district bounded as follows: beginning at the intersection of the center line of west 43rd street and a line 125 feet west of south State street, thence west along the center line of west 43rd street to a line 125 feet east of the east line of Wentworth avenue, thence south along said line 125 feet east of the east line of Wentworth avenue to the center line of west Garfield boulevard, thence east along the center line of west Garfield boulevard to a line 125 feet west of the west line of south State street, thence north along said line 125 feet west of the west line of south State street to the place of beginning.

(g) Excepting also the district bounded as follows: beginning at the intersection of the center line of west 40th street and the center line of Normal avenue, thence west along the center line of west 40th street to the center line of Wallace street, thence south along the center line of Wallace street to the center line of west 43rd street, thence west along the center line of west 43rd street to a line 125 feet east of the east line of south Halsted street, thence south along said line 125 feet east of the east line of south Halsted street to the center line of west 51st street, thence east along the center line of west 51st street to the center line of south Union avenue, thence south along the center line of south Union avenue to the center line of west Garfield boulevard, thence east along the center line of west Garfield boulevard to a line 125 feet west of the west line of Wentworth avenue, thence north along said line 125 feet west of the west line of Wentworth avenue to the center line of west 43rd street, thence west along the center line of west 43rd street to the center line of Normal avenue, thence north along the center line of Normal avenue to the place of beginning.

(h) Excepting also the district bounded as follows: beginning at the intersection of the center line of west 52nd street and the center line of south Peoria street, thence west along the center line of west 52nd street to the center line of south Morgan street, thence south along the center line of south Morgan street to the center line of west 53rd street, thence east along the center line of west 53rd street to the center line of south Peoria street, thence north along the center line of south Peoria street to the place of beginning.

(i) Excepting also the district bounded as follows: beginning at the intersection of a line 125 feet south of the south line of west 83rd street and the center line of south Winchester avenue, thence west along said line 125 feet south of the south line of west 83rd street to the east line of the right of way of the Pittsburgh, Chicago, Cincinnati and St. Louis Railway, thence southeasterly along the said east line of the right of way to the Pittsburgh, Chicago, Cincinnati and St. Louis Railway to the center line of west 87th street, thence east along the center line of west 87th street to the center line of Beverly avenue, thence southeasterly along the center line of Beverly avenue to the northwestern boundary line of the right of way of the Chicago, Rock Island and Pacific Railway Company in south Hermitage avenue, thence northeasterly in south Hermitage avenue along said northwestern boundary line of the right of way of the Chicago, Rock Island and Pacific Railway Company to the center line of south Winchester avenue, thence northwesterly and north along the center line of south Winchester avenue to the place of beginning.

(j) Excepting also the district bounded as follows: beginning at the intersection of the center line of west 91st street and a line 125 feet west of the west line of south Ashland avenue, thence west along the cen-

ter line of west 91st street to the center line of Beverly avenue, thence southeasterly along the center line of Beverly avenue to a line 125 feet west of the west line of south Ashland avenue, thence north along said line 125 feet west of the west line of south Ashland avenue to the place of beginning.

(k) Excepting also the district bounded as follows: beginning at the intersection of a line 125 feet south of the south line of west 95th street and the center line of Vincennes avenue, thence west along said line 125 feet south of the south line of west 95th street to the center line of Beverly avenue, thence southeasterly along the center line of Beverly avenue to the center line of Vincennes avenue, thence northeasterly along the center line of Vincennes avenue to the place of beginning.

(l) Excepting also the following territory, which shall be known as a provisional fire limit district: beginning at the intersection of the shore of Lake Michigan and the center line of Rogers avenue, thence southwesterly along the center line of Rogers avenue to the east line of the right of way of the Chicago and North Western Railway Company, thence south along the east line of the right of way of the Chicago and North Western Railway Company to the center line of Devon avenue, thence east along the center line of Devon avenue to the shore of Lake Michigan, thence northwesterly along the shore of Lake Michigan to the place of beginning.

(m) Excepting also the following territory which shall be known as a provisional fire limit district: beginning at the intersection of the shore of Lake Michigan and the center line of east 67th street, thence west along the center line of east 67th street to the center line of Cottage Grove avenue, thence north along the center line of Cottage Grove avenue, thence north along the center line of Cottage Grove avenue to the center line of east 63rd street, thence west along the center line of East 63rd street to the center line of South Park avenue, thence south along the center line of South Park avenue to the center line of east Marquette road, thence west along the center line of east Marquette road to the northeasterly line of the right of way of the Lake Shore and Michigan Southern Railway Company, thence northwesterly along the northeasterly line of the right of way of the Lake Shore and Michigan Southern Railway Company to the center line of south State street, thence south along the center line of south State street to the center line of east 75th street, thence east along the center line of east 75th street to the center line of Cottage Grove avenue, thence south along the center line of Cottage Grove avenue to a line 125 feet south of the south line of east 79th street, thence east along said line 125 feet south of the south line of east 79th street to the east line of the right of way of the Illinois Central Railroad, thence north along the east line of the right of way of the Illinois Central Railroad to the center line of east 79th street, thence east along the center line of east 79th street to the center line of Stony Island avenue, thence south along the center line of Stony Island avenue to a line 125 feet south of the south line of east 79th street, thence east along said line 125 feet south of the south line of east 79th street to the shore of Lake Michigan, thence northwesterly along the shore of Lake Michigan to the place of beginning.

(n) Excepting also the following territory which shall be known as a provisional fire limit district: beginning at the intersection of the center line of east 87th street and a line 125 feet east of the east line of the right of way of the Illinois Central Railroad, thence west along the center line of east 87th street to a line 125 feet west of

the west line of South Park avenue, thence south along said line 125 feet west of the west line of South Park avenue to the center line of east 95th street, thence east along the center line of east 95th street to a line 125 feet east of the east line of the right of way of the Illinois Central Railroad Company, thence northeasterly along said line 125 feet east of the east line of the right of way of the Illinois Central Railroad Company to the place of beginning.

Excepting also the following territory which shall be known as a provisional fire limit district: beginning at the intersection of a line 125 feet south of the south line of West 95th street and the center line of Vincennes avenue, thence west along said line 125 feet south of the south line of West 95th street to the center line of Beverly avenue, thence in a southeasterly direction along the center line of Beverly avenue to the center line of West 99th street, thence east along the center line of West 99th street, to the center line of Vincennes avenue, thence in a northeasterly direction along the center line of Vincennes avenue to the place of beginning.

The territory bounded on the south by the north side of West 95th street; on the north by the south side of West 90th street; on the east by the west side of South State street; and on the west by the east side of Wentworth avenue, shall be and the same is hereby excluded from the fire limits of the City of Chicago; provided, however, that it shall be unlawful to erect within said territory any buildings costing less than twenty-one hundred (\$2,100.00) dollars, except garages on the rear of the lots of said territory.

(o) Within the provisional fire limits above described it shall be lawful to erect a frame or wooden building to be used for residence or mercantile purposes upon presenting a petition to the commissioner of buildings, together with a plat, plans and specifications showing the space where such building is to be erected. Such petition shall be verified by the affidavit of the applicant and shall contain the written consent of the owners of a majority of the frontage upon both sides of the streets surrounding the square in which the proposed building is to be erected.

(p) No frame or wooden residence or mercantile building shall be erected within the provisional fire limits exceeding 40 feet in height.

935. **Maps showing fire limits.** As soon as practicable after the passage of this ordinance the superintendent of maps shall prepare, or cause to be prepared, three maps of the city of Chicago drawn to a scale sufficiently large to meet the requirements of this section, on which shall be accurately indicated the area and boundaries of the fire limits and of the provisional fire limits, as defined in the preceding section. Such maps shall be alike in all respects. One of said maps, when found to be accurate and in strict compliance with the foregoing section with respect to areas and boundaries, to the satisfaction of the mayor, shall be marked as approved by the mayor, and shall be placed in the custody of the city clerk, and the same shall be kept on file in the office of said clerk and regarded as an exhibit the same as if were a part of this ordinance. Another of said maps shall be turned over to the commissioner of buildings, whose duty it shall be to preserve the same, and to supervise the correction of all three of said maps from time to time as hereinafter provided. The third of said maps shall be retained by the superintendent of maps. Such maps may be altered, corrected, revised or replaced from time to time as the city council may direct.

After the passage of this ordinance the

city council, in future ordinances making changes in the fire limits or provisional fire limits of the city, may make reference to the said map on file in the city clerk's office, and may alter, correct or revise the fire limits or the provisional fire limits of the city by reference thereto or by stating what change shall be made to the fire limits or provisional fire limits as shown on said map; such references to said map, when clear and unambiguous, shall be deemed authoritative and shall be regarded as describing the areas and boundaries of the changed portion of the said fire limits or provisional fire limits regardless of whether the language of such ordinance correctly amends the preceding section or not; and such alterations, corrections and revisions, when duly passed, approved and published, shall be deemed amendments of the preceding section and shall be construed as altering, correcting and revising the fire limits as set forth in the preceding section.

It shall be the duty of the superintendent of maps to correct the said maps under the supervision of the commissioner of buildings so as to accurately portray the fire limits and provisional fire limits up to date whenever a change is authorized therein as by this section provided, and to replace the said maps with new maps when the city council so directs.

ARTICLE XXVI.

Regulations Concerning Places of Amusement.

936. **No amusement license to issue without certificate from city officials.)** No license shall be issued to any person, firm or corporation to produce, present, conduct, operate or offer for gain or profit, any theatricals, shows or amusements until the commissioner of buildings, the commissioner of health, the chief fire prevention Engineer and the commissioner of gas and electricity shall have certified in writing that the room or place where it is proposed to produce, present, conduct, operate or offer such theatricals, shows or amusements complies in every respect with the ordinances of the city of Chicago relating to their respective departments.

937. **Lighting—building kept lighted during performance.)** Every portion of any building or structure in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain or profit, devoted to the use or accommodation of the public, and all outlets therefrom leading to the street, including all open courts, corridors, stairways, exits and emergency exit stairways, shall be well and properly lighted during every performance, and shall remain lighted until the entire audience has left the premises. It shall be the duty of the chief fire prevention Engineer to enforce the provisions of this section.

938. **Independent lighting system for exits.)** All stairways and corridors in every building or structure in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain shall be supplied with a supplemental lighting system of electricity, gas or sperm oil, and such system shall be independent of all other lights in such building or structure and shall be in operation during the entire period that such building or structure is open to the public and until the entire audience has left the building.

The word "EXIT" shall appear in letters at least six inches high over the opening of every means of egress from such building or structure, and a red light shall be kept burning over such sign.

It shall be the duty of the commissioner of gas and electricity to enforce the pro-

visions of this section relative to the installation of the lighting provisions contained therein; and it shall be the duty of the chief of fire prevention and public safety to see that the lights are kept lighted as required by this section.

939. **Gas calcium lights prohibited—arc lights.)** The use of gas calcium lights in any building in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain is hereby prohibited.

All arc lights used on the stage shall be subject to the approval of the commissioner of gas and electricity.

940. **Exit doors or gates not to be locked—obstructions prohibited.)** No exit door or gate in any place in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain shall be locked or fastened in any manner during the entire time that such place of amusement is open to the public.

All aisles, passageways, corridors and exits of all such places of amusement shall be kept free from camp stools, chairs, sofas, draperies and other obstructions, and no person shall be allowed to stand in or occupy any of such aisles, passageways, corridors or exits during any performance.

941. **Diagram of exits and seats.)** It shall be the duty of the owner, lessee or manager of any theater having a seating capacity in excess of three hundred persons to cause to be printed on all programs furnished for any performance, on the page opposite to that upon which the cast is printed, a diagram showing conspicuously the place of every exit from such building. A diagram of the floor plan, showing the location of every seat on each floor, and also the exits leading from each floor, drawn to a scale of one-eighth of an inch to the foot, shall be posted in a conspicuous place at or near the box office of any such theater, so as to be easily seen by the public. It shall be the duty of the chief fire prevention Engineer to enforce the provisions of this section.

942. **Penalty.)** Any person, firm or corporation violating any of the provisions of this article shall be fined not more than two hundred dollars for each offense, and each and every day upon which any such person, firm or corporation shall give, conduct, produce, present, offer or operate any such entertainment contrary to or in violation of any of the provisions of this article shall constitute a separate and distinct offense.

ARTICLE XXVII.

NUISANCE AND PENALTY.

943. **Nuisance.)** (a) Every building or structure constructed or maintained in violation of this chapter, or which is in an unsanitary condition, or in an unsafe or dangerous condition or which in any manner endangers the health or safety of any person or persons, is hereby declared to be a public nuisance.

(b) Every building or part thereof which is in an unsanitary condition by reason of the basement or cellar being damp or wet, or by reason of the floor of such basement or cellar being covered with stagnant water, or by reason of the presence of sewer gas, or by reason of any portion of a building being infected with disease or being unfit for human habitation, or which, by reason of any other unsanitary condition, is a source of sickness, or which endangers the public health, is hereby declared to be a public nuisance.

944. **Theatres Located Above the First Floor Declared a Nuisance—Exceptions—**

Regulations.) It shall be and it is hereby declared to be a nuisance to conduct a public theatre in a room located on any floor above the first floor level of a building of other than fireproof construction or a building which did not comply with the ordinances of the City of Chicago with reference to fireproof construction in force at the time such building was built. All such public theatres now being conducted in rooms on any floor above the first floor level of a building of other than fireproof construction or a building which did not comply with the ordinances of the City of Chicago with reference to fireproof construction in force at the time such building was built, with a seating capacity of more than three hundred, shall be and they are hereby declared to be nuisances; and it shall be unlawful to continue to use such rooms for public theatrical purposes whether the same are equipped with a stage and scenery or are used for moving picture shows only.

The provisions of the foregoing paragraph shall not apply where the theatre is altered so as to bring the main audience room on the first floor level and slow-burning construction is used in the reconstruction work and in making such alterations and all requirements of the ordinances of the City applying to Class IVb are complied with, nor shall said provisions apply where the following conditions are fully complied with:

(a) The building shall be used for theatre purposes only.

(b) The seating capacity shall not exceed the seating capacity existing therein on July 22 1912.

(c) Metal scenery only shall be used; provided, however, one proscenium drop, one back drop and three borders may be used provided they are of asbestos cloth subject to the approval of the Chief Fire Prevention Engineer.

(d) All seats shall be at least eighteen inches wide and spaced thirty-two inches from back to back.

(e) There shall be no boxes, stalls or loges.

(f) No stove or furnace heating shall be allowed.

(g) All lighting shall be by electricity; provided, however, that gas may be used in connection with exit lights.

(h) At least sixty inches of exit space shall be provided for every one hundred seats.

(i) The stage shall not be more than twenty-two feet from front to rear.

(j) The audience room shall be surrounded by brick walls.

(k) In all cases where dressing rooms are placed back of the stage the brick wall shall extend between the stage and such dressing rooms, but the stage wall may contain a door leading to such dressing room located behind said wall.

(l) All dressing rooms shall have incombustible partitions and all existing wooden partitions, wherever located, shall be removed.

(m) There shall be an open space on at least three sides of the building containing such theatre, except as otherwise herein provided, which space shall be open from the floor level of the auditorium to the sky.

(n) One of such open spaces must be a public street and the others public or private alleys or open spaces leading directly to a street or public or private alley, and in all cases where such open space is private ground, it must be at least five feet wide where the seating capacity does not exceed six hundred, and six inches additional width must be provided for each one hundred seats installed in such theatre in excess of six hundred;

provided, however, that in all cases where a sprinkler system is installed over the stage, together with an approved power pump and pressure tank subject to the approval of the Chief Fire Prevention Engineer, it shall be sufficient if there are open spaces as above required on two sides of the building in which such theatre is located.

(o) Wherever the side of an audience room adjoins an open space, as hereinabove required, which open space is on private ground or is a private or public alley, there shall be a five-foot open iron platform extending the entire length of the audience room, with an open iron stairway leading to the ground from said platform at each end thereof, and in all such cases there shall be a stairway fire escape leading from the gallery of the theatre, if there is a gallery, to such platform.

(p) Where the only open space adjoining the side of the audience room is a public street, there shall be a five-foot stairway, enclosed by walls of incombustible material, leading from the middle of the audience room on the side contiguous to such street to the first floor, at the bottom of which stairway there shall be an exit opening directly to the street, and in such cases there shall be a three-foot stairway leading from the gallery, if there is a gallery, to the main floor of the auditorium, the bottom of which shall be within ten feet of the stairway leading from such main floor to the ground floor.

(q) There shall be an exit at least five feet wide on each side of the stage, which exit shall lead through a passageway constructed entirely of incombustible material to a stairway which shall be completely enclosed with incombustible material. Said stairway shall lead to the ground level and communicate through a passageway of incombustible material directly with a public street or alley or a private alley which leads directly to a public street or alley.

(r) An exit shall be provided on each side of the balcony or gallery at the end nearest the stage by means of a stairway of incombustible material leading to the main floor of the audience room.

(s) The exits at the front of the theatre shall communicate with stairways of incombustible material leading directly to the ground level and either opening directly out upon the street through fireproof passageways, and in no case shall any stairway leading from the main audience floor to the ground level communicate or connect with any other such stairway.

(t) All doors leading through the proscenium wall or from the stage to the dressing rooms shall be of incombustible material.

(u) All alterations made in buildings containing such theatres shall be of slow-burning construction, except as herein otherwise provided.

945. Penalty.) Any person, firm or corporation that violates, neglects or refuses to comply with, or who resists or opposes the enforcement of any of the provisions of this chapter, where no other penalty is provided, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense and every such person, firm or corporation shall be deemed guilty of a separate offense for every day on which such violation, neglect or refusal shall continue; and any builder or contractor who shall construct any building in violation of any of the provisions of this chapter, and any architect designing, drawing plans for, or having charge of such building, or who who shall permit it to be constructed, shall be liable to the penalties provided and imposed by this section.

HOUSING OF MOTOR VEHICLES IN FIREPROOF APARTMENT HOTELS AND APARTMENT BUILDINGS

Permission for the Use of Space for the Community Housing of Motor Vehicles belonging to Occupants of Fireproof Apartment Hotels and Apartment Buildings.

Be it ordained by the City Council of the City of Chicago:

Section 1. That apartment hotels and apartment buildings erected of fireproof construction may have in connection therewith either in a separate structure upon the same lot, or within the same structure, a space set apart for the community use of the occupants only of such apartment hotel or apartment building for the housing of self-propelled or motor-driven vehicles, provided the portion so used does not exceed in volume fifteen per cent (15%) of the total volume of structures upon the same lot, and provided that the portion so used complies with all of the requirements of this Chapter, the Sanitary Department, the Fire Prevention Bureau, and the Zoning Ordinance of the City of Chicago, and provided further that the portion so used when contained within the same structure shall be separated from habitable portions of such structure by walls of brick not less than 12 inches in thickness, or of hard-burned clay tile not less than 10 inches in thickness and plastered on

both sides with cement plaster 1 inch in thickness, or of concrete not less than 10 inches in thickness, and by floors of concrete or clay tile, or concrete and clay tile in combination not less than 12 inches in thickness.

Should that portion of such structure so used not exceed in volume seven per cent (7%) of the total volume of structures upon the same lot, then no frontage consents shall be required.

This ordinance shall not be construed as repealing or modifying any valid ordinances of the City of Chicago now in effect which restrict location of industries, entertainments, occupations, establishments or enterprises of any kind either by requiring frontage consents from property-owners or residents affected by such location, or by prohibiting or restricting the location of same within a fixed distance from a hospital, church, public school, or parochial school, or the grounds thereof, or on or near any class of streets or boulevards or any parks, playgrounds, or bathing beaches. As to all other ordinances or parts of ordinances in conflict with any of the provisions of this ordinance, the same are hereby repealed.

Section 2. This ordinance shall be in force and effect from and after its passage and approval.

REGULATIONS GOVERNING INSTALLATION OF WARM AIR HEATING PLANTS

Passed, December 28, 1927, as subsequently amended.

Be it ordained by the City Council of the City of Chicago:

Section 1. **Definition.** A gravity warm air heating plant shall consist of one or more warm air furnaces, enclosed within casings, together with necessary appurtenances thereto, consisting of warm air pipes and fittings, cold air or recirculating pipes, ducts, boxes and fittings, smoke pipes and fittings, registers, borders, faces and grilles, the same intended for the heating of buildings, in which they may be installed.

Section 2. **Minimum Requirements.** The provisions of this ordinance shall be held to be the minimum requirements adopted for the protection of health, welfare, sanitation and the safety of the community and for the protection of the ultimate purchaser or user of the heating plant.

Section 3. **Provisions in new buildings and in buildings already constructed.** The following provision shall be complied with in any building wherein a warm air heating plant is or is to be installed:

A. Buildings Under Construction.

The term "new buildings" as used in this ordinance, shall be construed to mean buildings which have not been and are not inhabited.

(1) Where warm air register boxes, heads, pipes or stacks are to be installed, joists shall be set not less than sixteen inches (16") on centers and shall be butted and not lapped. Studding shall be set directly over and under joists, leaving a space of not less than fourteen inches (14") between studs and joints. Wherever joists are cut, headers must be put in to support joists, in all buildings having studded exterior walls, the floors shall be extended to the outside sheathing and all spaces between studding shall be closed at the attic floor line.

(2) All partition walls (or sections of these walls) in which heat stacks to second or third floor rooms are to be installed, shall be of sufficient size to accommodate stacks required to heat said rooms.

(3) In new construction, it shall be unlawful for anyone to do any cutting of woodwork for the reception of the wall stacks or baseboard registers except the general contractor or the contractor in charge of the work for him, or some duly qualified carpenter working under him. Where it is necessary to cut joists or supporting members, headers shall be put in and braced so as not to weaken the structure.

B. Building Already Constructed.

The term "buildings already constructed", as used in this ordinance, shall be construed to mean completed buildings which have been or are inhabited.

(1) It shall not be necessary to remove the plaster and lath from the walls where the new stacks are to be run, provided that stacks have proper capacity for connecting basement pipe and can be securely fastened together and shoved in either from above or below.

(2) On buildings already constructed, it shall be lawful for the heating contractor to do any cutting necessary for the reception of all appurtenances in the installation of a gravity warm air heating plant.

(3) Otherwise, installation of new work in buildings already constructed shall, in general, conform to the provisions of this ordinance.

Rule A.

Each First Floor Room.

Divide square feet of glass by 12,

Divide square feet of net outside wall by

60,

(See Table A)

Divide cubic contents by 800,

Add together the above and multiply by 9,

The result is the area of the basement pipe.

The sum of:

Glass (sq. ft.) (Par. 5C) \div 12

Net Wall (sq. ft.) (Par. 6C) \div 60 \times 9 =

Cubic Contents \div 800 } Area of

basement pipe.

Rule B.

Each Second Floor Room.

Divide square feet of glass by 12.
Divide square feet of net outside wall by 60.

(See Table A)

Divide cubic contents by 800,
Add together the above and multiply by 6,
The result is the area of the basement pipe.
The sum of:
Glass (sq. ft.) (Par. 5C) $\div 12$ }
Net Wall (sq. ft.) (Par. 6C) $\div 60$ } $\times 6 =$
Cubic Contents $\div 800$ } Area of
basement pipe.

Rule C.

Each Third Floor Room.
Divide square feet of glass by 12,
Divide square feet of net outside wall by 60.

(See Table A)

Divide cubic contents by 800,
Add together the above and multiply by 5,
The result is the area of the basement pipe.
The sum of:
Glass (sq. ft.) (Par. 5C) $\div 12$ }
Net Wall (sq. ft.) (Par. 6C) $\div 60$ } $\times 5 =$
Cubic Contents $\div 800$ } Area of
basement pipe.

B. Basis of working rules for pipes.

These formulae are for 70 degrees temperature difference (outside temperature zero, inside temperature 70 degrees Fahrenheit). When temperature difference is more than 70 degrees, add $1\frac{1}{2}$ per cent per degree to final figures. When temperature difference is less than 70 degrees, deduct $1\frac{1}{2}$ per cent per degree from final figures.

The values as given in Table A for use in the working rules, Section 4, Rules A, B and C are derived as follows:—

Example.

The factor 60 in Table A, Item No. 1, is based upon a co-efficient of heat transmission of 0.23 B. t. u. per square foot per degree difference per hour, thus:

$W \times 0.23 \times 70 \div 111 =$ sq. in. first floor leader to compensate for the heat loss through walls only. In this, W=net area of exposed wall in sq. ft.; 0.23=co-efficient of transmission in B. t. u. per sq. ft. per degree difference per hr.; 70=difference in temperature of air on inside and outside of wall; 111=heat delivering capacity of 1 sq. in. of first floor leader pipe for a register temperature of 175° F. Reduced to its simplest approximate form this is

$$W \div 9$$

60

Likewise substitute 167 for second floor and 200 for third floor in place of 111.

The values in Table A for the different types of walls were obtained by substitution of proper co-efficient of heat transmission instead of 0.23 in the above formula.

Table A.

The factor 60 used in Section 4, Rules A, B and C, is for buildings constructed as hereinafter set forth in Item No. 1. When other types of walls are used substitute the appropriate factor as follows:

No. 1	Frame wall constructed of siding, paper sheathing, studding, lath and plaster	60
No. 2	Frame wall constructed of siding or stucco direct to sheathing (no paper), lath and plaster.....	52
No. 3	9" Brick Wall (no plaster).....	40
No. 4	9" Brick Wall plastered one side.	48
No. 5	9" Brick Wall, air space, furred and plastered	65
No. 6	13" Brick Wall, no plaster.....	53
No. 7	13" Brick Wall plastered one side.	57
No. 8	13" Brick Wall, air space, furred and plastered	75
No. 9	4" Brick, 1" hollow tile, plastered 55	

No. 10	4" Brick, paper, sheathing, studding, lath and plaster (brick veneer)	68
No. 11	8" Hollow tile, stucco and plaster	67
No. 12	8" Hollow tile, stucco, furred and plastered	90

Roofs.

No. 13	1" T. & G. Sheeting, tar and gravel	48
No. 14	1" T. & G. Sheeting and Composition roof	40
No. 15	1" T. & G. Sheeting and Tin.....	24
No. 16	Corrugated Iron on strips.....	9.3

Ceilings.

No. 17	Lath and plaster without floor above	50
No. 18	Lath and plaster with tight floor above	90
No. 19	Metal without floor above.....	40
No. 20	Metal with tight floor above.....	70

C. Method for Determining Size of Wall Stacks.

1. First Floor Rooms.
Same as Rule A.
2. Second Floor Rooms.
Not less than 70% of basement pipe area as determined in Rule C.
3. Third Floor Rooms.
Not less than 70% of basement pipe area as determined in Rule C.
4. Where one stack is used to convey heat to two rooms its net area shall be determined by adding together the areas of the two single stacks, which would be required to take care of the heat losses for each room were single stacks used.
5. In obtaining glass surface use full casement opening. An outside door is figured as glass.
6. To obtain net outside wall multiply height by width and deduct the glass in all windows and outside doors. For all rooms with attic spaces immediately above full ceiling areas shall be taken into account, using Table A.
7. For rooms having unusual exposure, ordinarily north, northeast and northwest, add 15% to pipe area. For east and west exposure add 10%.
8. Use no warm air pipe less than 8 inches in diameter. If a basement warm air pipe figures greater area than any standard commercial size then the nearest commercial size shall be used, provided however, that the total pipe area shall in no case be less than the total requirements according to Rules A, B and C.
9. It is understood in using the above values for determining basement warm air pipe areas, that these pipes should be run comparatively straight and that they should not be over 10 to 12 feet in length. Sharp turns and long pipes should have extra capacity.
10. The value of 800 (used in cubic contents) is for an estimated air change of one room volume per hour. If it is desired to provide for $1\frac{1}{2}$ room volume use the figure 600. If for two rooms volume use the figure 400.

D. Transition Fittings and Stacks.

1. Transition from warm air pipes to stacks shall be made with a well designed elbow or boot and no stack shall be less than 70% of the area of the warm air pipe leading to it.

2. All first floor fittings and connections shall maintain a free area equal to the round basement pipes leading to them.

E. Method for Determining Size of Registers.

1. All registers shall have a free area at

least equal to the area of the basement pipes leading to them.

F. Method for Determining Size of Furnace.

1. Add together the areas (expressed in square inches) necessary for heating the building, as determined by the foregoing **calculated** requirements, Section 4, Rules A, B and C, and install a furnace, rated by the following formula:

Furnace Rating Formula.

$$L = 1.75 G (1 \text{ plus } 0.02 (R-20))$$

L=square inches of warm air pipe connected to the furnace as calculated.

G=grate area in square inches; the area of the fire pot at the grate level; its most restricted area.

R=ration of heating surface area to grate area; 1.75—a constant based upon the results obtained on a furnace having 20 square feet of heating surface for each square foot of grate, and including factors for:

E=efficiency of heater;

C=combustion rate;

F=calorific value of fuel;

0.75=percentage of heat available at registers.

136=B. t. u. delivering value of one square inch of pipe, assuming half of the heat is sent to each floor. This value is based on an operating temperature of 175° F. at the register.

The formula allows 1.75 square inches of warm air pipe area for each square inch of grate area, for the furnace having a ratio of heating surface to grate surface of 20 to 1. For furnaces having other ratios of heating surfaces to grate surface, it adds 2% or deducts 2% for each unit above or below a ratio of 20.

Application.

	No. 1 Positive Correction	No. 2 No. Correction	No. 3 Negative Correction
Grate area, sq. in.	316	316	316
Heating surface area sq. in.	7540	6920	5665
Ratio heating surface area to grate area	21.8 to 1	20.0 to 1	16.4 to 1
R-20	1.8	0.0	-3.6
Correction per cent	3.6	0.0	-7.2
1.75 G	606	606	606
L = 1.75 G plus Correction	628	606	562

2. In second floor duplex, flats or apartments where separate heating plants are used, add 50% to the total net calculated areas as determined in Section 4, C 2. This represents the required warm air pipe capacity in square inches of the furnace for the second floor.

Section 5. Installation).

A. Location of Furnace.

The location of the furnace shall equalize the length of warm air runs as far as possible, yet give necessary preference to pipes supplying living rooms, dining rooms and main halls.

B. Foundation.

Furnace foundation of brick, cement, or other incombustible material must be provided. Said foundation to extend at least fifteen inches (15") at rear and sides of furnace casing and at least thirty-six inches (36") in front of furnace casing. Foundation to be level. Where a furnace is to be placed on combustible material, the specifications of

the National Board of Fire Underwriters shall be complied with.

C. Setting or Assembling of Furnace.

(1) The base ring of the furnace shall be cemented to the foundation, making an air tight joint. The furnace parts shall be assembled plumb and level, and in a workmanlike manner.

(2) All sections and joints shall be properly fitted. Joints requiring cement shall be well filled and all bolts shall be drawn up tightly.

(3) Every warm air furnace shall be equipped with a water pan or humidifying device to evaporate moisture in the air.

D. Casings.

(1) Warm air furnaces shall be enclosed in metal casings or walls of brick, tile or concrete.

(2) Portable. Sheet metal casings, including casing tops, shall be made of galvanized sheets, not lighter than 26-U. S. Standard Gauge. They shall fit the casings and casing rings closely, so as to be dust tight, and shall be securely fastened to the front. The casing shall be lined from the upper casing ring down to a line on a level with the grate.

(3) When side collars are used the casing top must be of sufficient height so that the largest warm air pipe can be taken from side without ovaling. In no case shall a distance less than eight inches (8") be maintained between the top of any furnace and the top line of the bonnet.

(4) Any furnace, the casing top of which shall come within twelve inches (12") of a combustible floor, ceiling or joist, shall be protected by a metal shield, extending not less than eighteen inches (18") beyond the casing of said furnace. This shield shall be suspended at least two inches below wood work, allowing free air space between shield and woodwork. No furnace casing or top, coming nearer than six inches (6") of ceiling or joists shall be allowed in any case.

(5) Openings for side casing collars shall be cut into the casing top, so that the tops of all openings are on a level. Casing collars shall be fitted into place with a proper flange, or bead on the outside and drawn up on the inside, making a dust tight joint. All collars shall be of same size as the warm air pipes to which they are to be connected.

(6) Brick, cement or hollow tile casing shall be constructed as follows: Walls shall be not less than eight inches (8") in thickness, and shall be constructed air tight. The least inside dimension of rectangular casing shall be the same as that of the portable casing of a corresponding size of furnace. Walls shall be carried to the same height as the portable walls, allowing not less than eight inches (8") between the top of the furnace and the bottom of the top cover. After placing the collars for the warm air pipes, continue the masonry up 2" above the top of the collars, lay single or tee irons across the furnace top, spaced 8", cover these with sheet metal not less than 26 U. S. S. Gauge, cover the sheet metal with masonry or sand and run the side walls four inches (4") above the roof of the furnace. A galvanized iron casing bonnet may be used on a brick set furnace.

Provisions shall be made in the walls for a manhole to give egress to heater.

E. Warm Air Pipes in Basement.

(1) All warm air pipes shall be made of bright tin not lighter than IC, or galvanized iron. All elbows shall be made of bright tin not lighter than IC, or galvanized iron, and shall be four piece, 90 degree. Side seams shall be locked seams. All joints shall be either double seamed or lapped not less than one and one-quarter inches (1 1/4") and such joints shall be match-beaded, or beaded and soldered, or riveted. All pipes and fittings

shall be properly secured to ceiling or joist. No solder or riveted joint is required where round pipe slips over the casing collar or enters boot or box. Any pipe fourteen inches (14") or greater in diameter shall not be made of material lighter than IX tin or No. 26 U. S. Standard Gauge galvanized iron.

Note—It is recommended that all warm air pipes in the basement shall have an upward pitch of not less than one inch (1") per running foot.

(2) All warm air pipes in the basement shall be provided with dampers supported on both sides not more than two feet from the casing.

(3) Where warm air pipes pass through a masonry wall, a metal thimble shall be provided, having a diameter at least 1" greater than the pipe, and the pipe supported in such a manner that the air space is uniform on all sides.

(4) All openings around first floor, wall and floor boxes and stacks to upper floors shall be sealed dust-tight.

F. Wall Stacks.

(1) All wall stacks or wall pipes, heads, boots, elbows, tees, angles and other connections shall be made of bright tin or galvanized iron and shall be covered with not less than one thickness of 12-pound per one hundred square foot of asbestos paper. All such pipes shall be braced in a proper manner so as not to obstruct the flow of air but to retain the full capacity throughout. All joints shall be fastened securely and the stacks held in place by means of lugs, or straps.

(2) All warm air stacks shall be run in inside walls. Where it is absolutely necessary to run same in outside walls, they shall be insulated with mineral wool or not less than three (3) thicknesses of air cell asbestos paper.

G. Registers.

(1) When baseboard or wall registers are used, they shall be attached to the stack head in such a manner that will prevent any leakage of air between the head and the register.

(2) Any furnace system having not more than two warm air registers, at least one of the registers shall be without valve or louvers and the pipe thereto shall be without damper.

H. Air Supply to Furnace.

(1) The air supply to furnace for warm air heating plants may be taken from outside or from within the building, or may be taken partially from outside and partially from within. In no case, however, shall air be supplied to any furnace from any basement or furnace room.

(2) The cold air intake or return where air is taken from within the building shall have a net area throughout its entire length of not less than the combined net area of all warm pipes leading from the furnace. This may be maintained in one or more ducts. No reverse incline or air trap will be allowed in any section thereof.

(3) When the cold air supply is taken wholly from the outside of the building the supply duct at its most contracted area must equal or exceed eighty per cent (80%) of the combined area of all warm air pipes leading from the furnace.

(4) Cold air ducts shall maintain a constant net area throughout their entire length and shall be made dust tight. Horizontal return ducts shall have at least 10% greater area than vertical connecting pipes. Where a boot or shoe is connected to the casing at the base, the opening shall not extend higher than a line on the level of the grate of the furnace. The width of the shoe shall be of proper measurement to make the area at least equal to that of the round or square pipe to which it is connected.

(5) Wherever the space between joists is used to convey cold air over head, such space shall be at least 10% greater than the area of the connecting pipe, and shall be sealed and air tight.

(6) When it is necessary to set the furnace over a pit and connect up cold air under the basement floor, such pit or cold air trench shall not exceed eighteen inches (18") in depth below the casing ring and the width of the trench or trenches shall be of proper measurement to make the area at least equal to the pipe to which it is connected. The connection between the cold air pipe or duct and the underground pit shall be made with converse transition joint.

(7) The cold air face or faces shall be made of wood or metal. When set in floors the top of wood faces shall be flush with floor. Where cold air face is placed in a seat or side wall the open work of face must extend to within at least one-quarter inch ($\frac{1}{4}$ ") of the floor line.

(8) The free area of cold air faces shall be at least equal to the free area of the duct or ducts to which they are connected.

(9) The capacity of any vertical cold air face shall be determined by multiplying the base line in inches by not to exceed fourteen inches (14") in height and deducting for the grills or cross bars.

I. Smoke Pipes.

(1) The smoke pipe shall be as short and direct as consistent with the location of the furnace. It shall be made of metal not lighter than No. 24 U. S. Standard Gauge and not less than the full size of the collar on the furnace throughout its entire length. It must have no opening for attaching any fire place, stove, range, water heater, gas or ventilating connection. It shall be lock seamed or riveted; all joints shall lap not less than one and one-half inches ($1\frac{1}{2}$ ") and it shall be rigidly secured. Cast iron smoke pipe may be used.

(2) All smoke pipes shall be provided with check dampers, placed on the side of the pipe or at the end of a tee; when cast iron smoke pipe dampers are used they must be placed between the check damper and the furnace and supported on both sides of the pipe.

(3) Where the smoke pipe enters the flue, a thimble shall be cemented into the flue and the connections thereto made air tight. Should any smoke pipe come within eighteen inches (18") of any combustible material, such combustible material must be covered with asbestos paper and a metal shield so fastened that a two inch air space exists between this shield and the combustible material. This shield shall be no less in size than twice the diameter of the smoke pipe and of sufficient length to cover the combustible material at all points.

(4) No smoke pipe shall project through any external wall or window.

J. Pipeless or One Pipe Furnaces.

(1) When but one duplex grating is used for both warm air and cold air, in a so-called pipeless furnace, the area of the cold air intake shall be at least equal to the area of the warm air outlet of the grating. Section 5, D, relative to casing shall not govern when this type of furnace is installed, but the following specification shall be followed: The inner and outer casing of this type of furnace may be made of either black or galvanized iron not lighter than No. 26 U. S. Standard Gauge. A uniform air space shall be maintained at all points between the inner and outer casing. In no case shall the top of the heater be allowed closer than twelve inches (12") to any ceiling or joists above the furnace.

(2) Where joists are cut to accommodate this furnace, headers shall be put in and braced.

(3) Section Four for determining area of warm air pipe shall not govern in figuring a pipeless furnace.

(4) Where one warm air register face is used and separate face or faces for cold air supply are used, then Section No. 5 E, G and H shall apply.

K. Permit.

(1) It shall be unlawful for any person, persons, firm or corporation to construct, replace or install any warm air heating furnaces or appurtenances thereto within the City of Chicago without first obtaining from the Commissioner of Buildings a permit to do such work, for which said person, persons, firm or corporation shall pay to said Commissioner of Buildings for the use of said City, for each furnace installed, renewed or repaired the sum of five dollars (\$5.00).

(2) No heating permits shall be required for minor repair work. By minor repair work is meant the incidental repairs to furnaces, which shall not affect the general action of the system, such as renewal of grates, smoke pipes and resetting old furnace in same location; or renewing of single warm air pipes in basement; but when additional runs or new stacks are installed, a permit shall be required, for which the person, firm or corporation installing said additional runs or new stacks shall pay to the Commissioner of Buildings for the use of said City, the sum of one dollar (\$1.00) for each outlet.

L. Inspection.

(1) It shall be the duty of the Commissioner of Buildings to cause an inspection to be made of all warm air furnaces and the appurtenances thereto hereafter installed by an inspector who is an experienced and competent Journeyman Sheet Metal Worker and see that same is installed or constructed in conformity to the provisions of this ordinance. The expenses of such inspection shall be paid out of the fees received for permits to install or construct such warm air furnaces and appurtenances.

(2) Inspection of new work in new buildings shall be made as follows: When such work has proceeded to where the stacks to upper floors and heads for all side wall registers have been installed, boots connected thereto, the contractor, or person obtaining permit for this work, shall notify the Commissioner of Buildings, who shall make or cause to be made an inspection of such work. Upon finding that the work complies in all respects with the terms of this ordinance there shall be affixed by said Commissioner of Buildings, or his representative, to each stack register head, a certificate stating that the work complies with the ordinance relating thereto.

(3) Inspection of new work in buildings already constructed, shall be made only after installation is completed.

(4) Final inspection of plant shall be made after the whole is connected up and ready to operate.

(5) It shall be unlawful for any person to lath over, plaster or cover up any warm air heating work before such work in new buildings or completed buildings where plaster and lath have been removed has been inspected and certificates above referred to have been attached. The Commissioner of Buildings shall have the right and authority to remove or order removed all such lath, plaster or other coverings which may have been placed over such work before same has been inspected. The person, persons, firm or corporation ordering or causing such work to be covered up, or in any way violating any section of this ordinance as herein set forth, shall, upon conviction, be subject to the penalties set forth for violation of the terms of this chapter.

Section 6. Registration). It shall be unlawful for any person, firm or corporation to engage in the business of installing gravity warm air heating plants with necessary appurtenances thereto as heretofore defined without being registered as a warm air furnace heating and installing contractor in the manner hereinafter set forth provided, however, that if such person, firm or corporation is already registered for the current year in another city or village within the State of Illinois, such contractor shall not be required to be registered or to pay a registration fee in this city.

Section 7. Application for Registration). Any person, firm or corporation desiring to engage in the business of warm air furnace heating and installing contractor shall apply for registration to the Commissioner of Buildings. Upon the filing of such application in proper form and the payment of registration fee fixed herein, the Commissioner of Buildings shall register the applicant as a warm air furnace heating and installing contractor and shall issue to the applicant a Certificate of Registration which will authorize the applicant to engage in such business for the year in which it is issued; providing that such applicant has filed with the City Clerk an Indemnifying Bond as hereinafter set forth. The Commissioner or Buildings shall keep a suitable record of such registrations.

Section 8. Bond). Prior to the issuance of a certificate of registration for warm air furnace heating and installing contractor, the applicant shall file with the City Clerk of the City of Chicago, an indemnifying bond with good and sufficient sureties in the penal sum of ten thousand dollars (\$10,000.00) such bond being payable to the City of Chicago, for the use of any persons, firms or corporations with whom such applicant shall thereafter contract to do work, to indemnify any such persons, firms or corporations for damages sustained on account of the failure of such applicant to perform the work so contracted for, in accordance with the provisions and requirements of the City of Chicago relating to the installation of gravity warm air heating plants with necessary appurtenances thereto.

Section 9. Fee for Registration—Term). The fee for registration as a warm air furnace heating and installing contractor shall be fifty dollars (\$50.00) per annum which sum shall be paid by the applicant to the City Clerk in advance upon filing his application. The certificate of registration issued thereunder shall expire on the 31st day of December of the year in which it is issued.

Section 10. Validity). Should any section or provision of this ordinance be held unconstitutional or invalid by any court, all other sections and provisions shall nevertheless be deemed as effective as though such unconstitutional or invalid section or provisions had never been inserted in this ordinance.

Section 11. All ordinances, or parts of ordinances, inconsistent with the provisions of this ordinance are hereby repealed.

Section 12. Penalty). Any person, firm or corporation that shall engage in the business of a warm air furnace heating and installing contractor without obtaining a certificate of registration as herein provided for, or that shall violate any of the provisions of this ordinance shall be fined not less than fifty dollars (\$50.00) nor more than two hundred dollars (\$200.00) for each offense, and a separate and distinct offense shall be regarded as committed every day on which such person, firm or corporation shall continue to operate contrary to the provisions of this ordinance.

Section 13. This ordinance, including the provisions and penalty therein set forth, shall take effect and be in force from and after its passage and due publication.

Special Rulings of the Building Department of the City of Chicago

These rulings are not a part of the Code of the City of Chicago; but are requirements of the Building Department.

BRACING OF TRUSSES, COLUMNS, WALLS, ETC., IN STEEL SKELETON CONSTRUCTION.

I.

In regard to Section 781 of the Revised Building Ordinances, the Commissioner has ruled that the following interpretation shall be placed upon the section concerning bracing:

(a) All skeleton buildings, trusses, and structures shall be securely braced during erection by guys, cables or such other temporary supports as may be necessary to provide for stresses due to erection.

(b) Special wind bracing shall be provided in steel skeleton buildings over one hundred (100) feet in height or higher than twice the least width.

(c) For permanent construction bracing shall be so designed that the skeleton will be self-supporting and safe against lateral and buckling or crippling forces before any of the inclosing walls or roofs are built in place.

(d) In cases where wind forces are nominal and to prevent buckling or crippling, the minimum amount of bracing required shall be $\frac{3}{4}$ " rod for steel tension members or equivalent in other material. Compression members shall be limited in length to one hundred and fifty (150) times the least radius of gyration or otherwise as specified in the Ordinances.

(e) Trusses shall be properly anchored to the walls at the point of bearing in such a way as not to strain the masonry on account of the temperature stresses in the truss.

(f) In general, all eccentric loading on the foundations shall be avoided and where not possible to do so, proper bracing between opposite walls shall be provided, sufficient to offset the bending moment due to eccentricity.

NOTES ON REINFORCED CONCRETE DESIGN.

II

(a) In regard to Section 763, as applying to a combination of tile and concrete construction, the Commissioner has ruled that the width of flange of the concrete joists may be assumed as the full distance c. to c. of ribs but not exceeding eight (8) times the thickness of the concrete on top of tile fillers, plus the average width of rib.

(b) In computing the shear at supports, the average width of the concrete rib plus the thickness of the tile on one side of the rib may be figured as the effective width of joist, provided that joints in tile are properly staggered.

(c) When steel or plaster fillers are used between concrete joists, the width of flange shall be limited to three-fourths ($\frac{3}{4}$) of the distance center to center of ribs as per Section 763.

In regard to Section 760 (e)

(a) When compression is applied to a surface of concrete of at least twice the loaded area, a stress of thirty (30) per cent of the ultimate may be allowed, and

(b) In continuous beams and girders the compressive stress in extreme fibre at the support may be fifteen (15) per cent greater than at the center of span.

In regard to Section 762 (1)

The total amount of steel required for square slabs with two-way reinforcement may be reduced twenty (20) per cent by gradually increasing the rod spacing from the third point to the edge of the slab.

THE DESIGN OF FLAT SLABS SHALL BE IN ACCORDANCE WITH THE FOLLOWING RULING.

III

Definitions.

(1) Flat slabs as understood by this ruling are reinforced concrete slabs, supported directly on reinforced columns with or without plates or capitals at the top, the whole construction being hingeless and monolithic without any visible beams or girders. The construction may be such as to admit the use of hollow panels in the ceiling or smooth ceiling with depressed panels in the floor.

(2) The column capital shall be defined as the gradual flaring out of the top of the column without any marked offset.

(3) The drop panel shall be defined as a square or rectangular depression around the column capital extending below the slab adjacent to it.

(4) The panel length shall be defined as the distance center to center of columns of the side of a square panel, or the average distance center to center of columns of the long and short sides of a rectangular panel.

Columns.

(5) The least dimension of any concrete column shall be not less than one-twelfth (1/12) the panel length, nor one-twelfth (1/12) the clear height of the column.

Slab Thickness.

(6) The minimum total thickness of the slab in inches shall be determined by the

$$\text{formula: } t = \frac{W^{1/2}}{44} = \text{square root of } W \text{ divided by forty-four, where } t = \text{total thickness of slab in inches, } W = \text{total live and dead load in pounds on the panel, measured center to center of columns.}$$

(7) In no case shall the thickness be less than one thirty-second of the panel length (1/32) for floors, nor one-fortieth of the panel length (1/40) for roofs, (L being the distance center to center of columns).

(8) In no case shall the thickness of slab be less than six inches (6") for floors or roofs.

(9) When used the diameter of the column capital shall be measured where its vertical thickness is at least one and one-

Column Capital.

(9) When used the diameter of the column capital shall be measured where its vertical thickness is at least one and one-

half inches ($1\frac{1}{2}$ "), and shall be at least two hundred and twenty-five thousandths (.225) of the panel length.

The slope of the column capital shall nowhere make an angle with the vertical of more than forty-five degrees. Special attention shall be given to the design of the column capital in considering eccentric loads, and the effect of wind upon the structure.

Drop Panel.

(10) When used, the drop panel shall be square or circular for square panels and rectangular or elliptical for oblong panels.

(11) The length of the drop shall not be less than one-third of the panel length ($L/3$) if square, and not less than one-third of the long or short side of the panel respectively, if rectangular.

(12) The depth of the drop panel shall be determined by computing it as a beam, using the negative moment over the column capital specified elsewhere in this ruling.

(13) In no case, however, shall the dimensions of the drop panel be less than required for punching shear along its perimeter, using the allowable unit shearing stresses specified below.

Shearing Stresses.

(14) The allowable unit punching shear on the perimeter of the column capital shall be three-fiftieths ($3/50$) of the ultimate compressive strength of the concrete as given in section 759 of the building ordinance. The allowable unit shear on the perimeter of the drop panel shall be three one-hundredths ($3/100$) of the ultimate compressive strength of the concrete. In computing shearing stress for the purpose of determining the resistance to diagonal tension the method specified by the ordinance shall be used.

Panel Strips.

(15) For the purpose of establishing the bending moments and the resisting moments of a square panel, the panel shall be divided into strips known as strip A and strip B. Strip A shall include the reinforcement and slab in a width extending from the center line of the columns for a distance each side of this center line equal to one-quarter ($1/4$) of the panel length. Strip B shall include the reinforcement and slab in the half width remaining in the center of the panel. At right angles to these strips, the panel shall be divided into similar strips A and B, having the same widths and relations to the center line of the columns as the above strips. These strips shall be for designing purposes only, and are not intended as the boundary lines of any bands of steel used.

(16) These strips shall apply to the system of reinforcement in which the reinforcing bars are placed parallel and at right angles to the center line of the columns, hereinafter known as the two-way system, and also to the system of reinforcement in which the reinforcing bars are placed parallel, at right angles to and diagonal to the center line of the columns hereinafter known as the four-way system.

(17) Any other system of reinforcement in which the reinforcing bars are placed in circular, concentric rings and radial bars, or systems with steel rods arranged in any manner, whatsoever, shall comply with the requirements of either the two-way or the four-way system herein specified.

Bending Moment Coefficients, Interior Panel, Two-way System.

(18) In panels where standard drops and column capitals are used as above specified, the negative bending moment taken at a cross-section of each strip A at the edge of the column capital or over it, shall be taken

$$\text{as } \frac{WL}{30}$$

(19) The positive bending moment taken at a cross-section of each strip A midway between column centers, shall be taken as

$$\frac{WL}{60}$$

(20) The positive bending moment taken at a cross-section of each strip B in the

$$\text{middle of the panel shall be taken as } \frac{WL}{120}$$

(21) The negative bending moment taken at a cross-section of each strip B on the center line of the columns shall be taken as

$$\frac{WL}{120}$$

(22) In the formulas hereinabove given "W" = total live and dead load on the whole panel in pounds,

"L" = panel length, center to center of columns.

Bending Moment Coefficients, Interior Panel, Four-way System.

(23) In panels where standard drops and column capitals are used as above specified, the negative bending moment taken at a cross-section of each strip A at the edge of column capital or over it, shall be taken as

$$\frac{WL}{30}$$

(24) The positive bending moment taken at a cross-section of each strip A, midway between column centers shall be taken as

$$\frac{WL}{80}$$

(25) The positive bending moment taken at a cross-section of each strip, B, taken in the middle of the panel shall be taken as

$$\frac{WL}{120}$$

(26) The negative bending moment taken at a cross-section of each strip B on the center line of the columns shall be taken as

$$\frac{WL}{120}$$

Bending Moment Coefficients, Wall Panels.

(27) Where wall panels with standard drops and capitals are carried by columns and girders built in walls, as in skeleton construction, the same coefficients shall be used as for an interior panel, except as follows: The positive bending moments on strips A and B midway between wall and first line of columns shall be increased twenty-five (25%) per cent.

(28) Where wall panels are carried on new brick walls, these shall be laid in Port-

land cement mortar and shall be stiffened with pilasters as follows. If a sixteen-inch wall is used, it shall have a four-inch pilaster. If a twelve-inch wall is used, it shall have an eight-inch pilaster. The length of pilasters shall be not less than the diameter of the column, nor less than one-eighth ($\frac{1}{8}$) of the distance between pilasters. The pilasters shall be located opposite the columns as nearly as practicable, and shall be corbeled out four inches at the top, starting at the level of the base of the column capital. Not less than eight (8") inches bearing shall be provided for the slab, the full length of wall.

The coefficients of bending moments required for these panels shall be the same as those for the interior panels except as provided herewith: The positive bending moments on strips A and B midway between the wall and first line of columns shall be increased fifty (50%) per cent.

(29) Where wall panels are supported on old brick walls, there shall be columns with standard drops and capitals built against the wall which shall be tied to the same in an approved manner, and at least an eight-inch bearing provided for the slab, the full length. Where this is impracticable, there shall be built a beam on the underside of slab adjacent to the wall between columns, strong enough to carry twenty-five (25%) per cent. of the panel load.

The coefficients of bending moments for the two cases of slab support herein described shall be the same as those specified in Sec. 27 and Sec. 28 for skeleton and wall bearing condition respectively.

(30) Nothing specified above shall be construed as applying to a case of slabs merely resting on walls or ledges, without any condition of restraint. These shall be figured as in ordinary beam and girder construction specified in the Ordinances.

Bending Moment Coefficients, Wall and Interior Columns.

(31) Wall columns in skeleton construction shall be designed to resist a bending mo-

ment of $\frac{WL}{60}$ at floors and $\frac{WL}{30}$ at roof. The

amount of steel required for this moment shall be independent of that required to carry the direct load. It shall be placed as near the surface of the column as practicable on the tension sides, and the rods shall be continuous in crossing from one side to another. The length of rods below the base of the capital and above the floor line shall be sufficient to develop their strength through bond, but not less than forty (40) diameters, nor less than one-third ($\frac{1}{3}$) the clear height between the floor line and the base of the column capital.

(32) The interior columns must be analyzed for the worst condition of unbalanced loading. It is the intention of this ruling to cover ordinary cases of eccentric loads on the columns by the requirement of Sec. 5. Where the minimum size of column therein specified is found insufficient, however, the effect of the resulting bending moment shall be properly divided between the adjoining slab and the columns above and below according to best principles of mechanics and the columns enlarged sufficiently to carry the load safely.

Bending Moment Coefficients, Panels Without Drops, or Capitals, or Both.

(33) In square panels where no column capital or no depressions are used, the sum total of positive and negative bending mo-

ments shall be equal to that computed by the following formula:

$$B.M. = \frac{WL}{8} (1.53 - 4k + 4.18 k^3)$$

where B.M. = numerical sum of positive and negative bending moments, regardless of algebraic signs.

W = total live and dead load on the whole panel.

L = length of side of a square panel, c. to c. of columns.

K = ratio of the radius of the column or column capital to panel length, L.

This total bending moment shall be divided between the positive and the negative moments in the same proportion as in the typical square panels for two-way or four-way systems specified above for interior and wall panels respectively.

Points of Inflection.

(34) For the purpose of making the calculations of the bending moment at the sections away from the column capitals, the point of inflection shall be considered as being one-quarter ($\frac{1}{4}$) the distance center to center of columns, both cross-wise and diagonally, from the center of the column.

Tensile Stress in Steel and Compressive Stress in Concrete.

(35) The tensile stress in steel and the compressive stress in the concrete to resist the bending moment shall be calculated on the basis of the reinforcement and slab in the width included in a given strip, and according to the assumption and requirements given in sections 758 to 761 inclusive of the building ordinance.

The steel shall be considered as being concentrated at the center of gravity of all the bands of steel in a given strip.

(36) For the four-way system of reinforcement the amount of steel to resist the negative bending moment over the support in each strip A shall be taken as the sum of the areas of steel in one cross band and one diagonal band. The amount of steel to resist the positive bending moment of each strip B shall be considered as the area of the steel in a diagonal band. The amount of steel to resist the positive bending moment in each strip A shall be considered as the area of the steel in a cross-band, and the amount of steel to resist the negative moment in each strip B shall be the steel included in the width of strip B.

(37) For the two-way system of reinforcement the amount of steel to resist the bending moment in any strip shall be considered as the area of steel included in the width of the strip.

(38) In both systems of reinforcement the compressive stress in the concrete in any strip shall be calculated by taking the area of steel considered for each strip, and applying it in a beam formula based on the principles of section 761 of the building ordinance.

(39) Where drop panels are used, the width of beam assumed to resist the compressive stresses over the column capital shall be the width of the drop.

(40) The width of beam where no drop panels are used, shall be the width of steel bands. Where this is found insufficient, the area shall be increased by introducing compression steel in the bottom of slab.

Rectangular Panels.

(41) When the length of panel in either two-way or four-way system does not exceed the breadth by more than five (5%) per cent, all computations shall be based on a square panel whose side equals the mean of the length and breadth, and the steel equally distributed among the strips according to the coefficients above specified.

(42) In no rectangular panel shall the length exceed the breadth by more than one-third (1/3) of the latter.

Rectangular Panels, Four-Way System.

(43) In the four-way system of reinforcement where length exceeds breadth by more than five (5%) per cent, the amount of steel required in strip A, long direction, both positive and negative, shall be the same as that required for the same strip in a square whose length is equal to the long side of the rectangular panel.

(44) The amount of steel, strip A, short direction, positive and negative, shall be the same as that required for the same strip in a square panel, whose length is equal to the short side of the rectangular panel.

(45) The amount of steel in strip B, positive and negative, shall be the same as that required for similar strip in a square panel whose length is equal to the mean of the long and the short side of the rectangular panel.

(46) In no case shall the amount of steel in the short side be less than two-thirds (2/3) of that required for the long side.

Rectangular Panels, Two-way System.

(47) In the two-way system of reinforcement the amount of steel required for the positive and the negative moment of each strip A shall be determined in the same manner as indicated for the four-way system above.

(48) The amount of steel in strip B, positive and negative, running in short direction, shall be equal to that required for the same strip in a square panel whose length equals the long side of the rectangular panel.

(49) The amount of steel in strip B, long direction, positive and negative, shall be equal to that required for the same strip in a square panel, whose length equals the short side of the rectangular panel.

(50) In no case shall the amount of steel in strip B, long direction, be less than two-thirds (2/3) of that in the short direction.

Walls and Openings.

(51) Girders and beams shall be constructed under walls, around openings and to carry concentrated loads.

Spandrel Beams.

(52) The spandrel beams or girders shall, in addition to their own weight and the weight of the spandrel wall, be assumed to carry twenty (20%) per cent of the wall panel load uniformly distributed upon them.

Placing of Steel.

(53) In order that the slab bars shall be maintained in the position shown in the design during the work of pouring the slab, spacers and supports shall be provided satisfactory to the Commissioner of Buildings. All bars shall be secured in place at intersections by wire or other metal fastenings. In no case shall the spacing of the bars exceed nine inches (9"). The steel to resist the negative moment in each strip B shall extend one-quarter ($\frac{1}{4}$) of the panel length beyond the center line of the columns in both directions.

(54) Splices in bars may be made wherever convenient, but preferably at points of minimum stress. The length of splice beyond the center point, in each direction, shall not be less than forty diameters (40d) of the bars, nor less than two feet (2'0"). The splicing of adjacent bars shall be avoided as far as possible.

(55) Slab bars which are lapped over the column, the sectional area of both being included in the calculations for negative moment, shall extend not less than twenty-five one-hundredths (.25) of the panel length for cross-bands, and thirty-five one-hundredths (.35) of the panel length for diagonal bands, beyond the column center.

Computations.

(56) Complete computations of interior and wall panels and such other portions of the building as may be required by the Commissioner of Buildings shall be left in the office of the Commissioner of Buildings when plans are presented for approval.

Test of Workmanship.

(57) The Commissioner of Buildings or his representative may choose any two adjacent panels in the building for the purpose of ascertaining the character of workmanship. The test shall not be made sooner than the time required for the cement to set thoroughly, nor less than six weeks after the concrete has been poured.

(58) All deflections under test load shall be taken at the center of the slab, and shall be measured from the normal unloaded position of the slab. The two panels selected shall be uniformly loaded over their entire area with a load equal to the dead load plus twice the live load, thus obtaining twice the total design load. The load shall remain in place not less than twenty-four (24) hours. If the total deflection in the center of the panel under the test load does not exceed one eight-hundredth ($\frac{1}{800}$) of the panel length, the slab may be placarded to carry the full design live load. If it exceeds this amount of deflection, and recovers not less than eighty per cent (80%) of the total deflection within seven days after the load is removed, the slab may be placarded to carry the full design live load. If the deflection exceeds the allowable amount above specified, and the recovery is less than eighty per cent (80%) in seven days after the removal of the test load, other tests shall be made on the same or other panels, the results of which will determine the amount of live load the slabs will be permitted to carry.

General.

(59) The design and the execution of the work shall conform to the general provisions and the spirit of the Chicago Building Ordinances in points not covered by this Ruling, and to the best engineering practice in general.

Enforcement.

(60) This ruling shall be in effect on and after March first, Nineteen Hundred and Eighteen (March 1st, 1918), and shall supersede all previous rulings on flat slabs.

Signed: CHAS. BOSTROM,
Commissioner of Buildings.

FIREPROOFING OF REINFORCED CONCRETE COLUMNS.**IV**

In reference to Section 762-j and Section 776 of the Chicago Building Ordinance, the Commissioner has ruled that in buildings classed as ordinary construction the full section of the column may be calculated in columns reinforced with vertical rods only. In buildings classed as slow burning or mill construction, the outside one and one-half inches shall not be figured in columns reinforced with vertical rods only, and in buildings classed as fireproof construction the outside two inches shall not be figured in the strength of columns with vertical rods only. When spiral reinforcement is used, only the area within the core shall be figured in accordance with Section 764-b.

CAISSONS.**V**

Ruling.—In determining the area required for concrete caissons, the load on the caissons shall be the load for which the basement column was designed, and the allowable stress on the concrete shall be as given in Section 746 (a). The allowable stress used shall be the stress at the top of the caisson when caissons rest on rock. All caissons supporting such parts of buildings that exceed 260 feet in height shall rest on rock. Other caissons are permitted to be stopped before the rock is reached and the allowable stress used in such cases shall be calculated at the junction of the caisson and the lower bell. The allowable load on the soil for such caissons as do not rest upon rock shall include the weight of the caisson.

Approved: **FRANK E. DOHERTY**,
Commissioner of Buildings.

Ruling.

The diameter of a caisson may be increased for the purpose of forming a so-called bell at its lower extremity. The ratio of increase shall not exceed one unit of radius for each two units of added length or depth; and in no case shall the slope of the bell be flatter than thirty degrees with the perpendicular axis of the caisson.

The diameter at the bottom of the bell shall not exceed two and one-eighth times the diameter of the caisson proper, and said diameter shall be further limited to an ultimate dimension not to exceed three-fourths of the distance between the center of the column it supports and the center of the nearest adjacent column.

FRANK E. DOHERTY,
Commissioner of Buildings.

A RULING ON COUNTERBALANCE OF STAIRWAY FIRE ESCAPES.**VI**

The Commissioner of Buildings has made a ruling in regard to the construction of the movable part of stairway fire escapes as follows:

All counterbalance stairway fire escapes hereafter constructed shall conform to the following requirements in addition to those specified in the Building Ordinance for fixed stairway fire escapes, Section 882.

(a) The stringer carrying the counterweight may be built of steel channels, angles or "I" beams or any combination thereof, not less than eight inches deep and $\frac{3}{4}$ " metal, but it shall be so designed that the maximum fibre stress over the support shall not exceed 8,000 pounds per square inch and the moment of inertia about the vertical axis parallel to the web of the stringer shall not be less than 33% of the moment of inertia about the horizontal axis perpendicular to the web and passing through the center, which shall be accomplished by riveting an angle or angles onto the channel or "I" beam stringer.

(b) The same section of stringer shall be continued for equal distances on either side of the support and the reinforcement shall be extended as close to the counterweight as practicable.

(c) The truss rod from the counterweight to the opposite end of the stringer shall always be used either as an independent brace or in connection with the railing to prevent any sag of the stringer and shall be at least $\frac{3}{4}$ " in diameter firmly connected, the strength of connection to be sufficient to develop the strength of the rod, but in figuring stresses, the stringer must be assumed to carry the total dead and live load as required by the ordinance.

(d) The connection between the stringer and the supporting rod must be designed to stiffen the stringer securely against horizontal or twisting motion by means of a steel casting or forging riveted to the stringer both through the web and the flange.

ILLUMINATED AND OTHER ROOF SIGNS OF STEEL SKELETON CONSTRUCTION.**VII**

In regard to Section 919, of revised Building Ordinances, the Commissioner has ruled that all illuminated roof signs of steel construction shall conform to the following specific requirements:

(a) All compression members shall be proportioned by the usual formula, $16,000-701$ except that the length of the main or principal members R may be increased to one hundred and seventy-five (175) times the least radius of gyration, and the length of all secondary or sub-members may be increased to two hundred (200) times the same.

(b) The anchorage of every roof sign shall be designed with a factor of safety not less than two (2). I. e., there shall be at least twice as much weight of masonry or concrete resisting the pull on the anchors as figured from the overturning effect of wind.

(c) The thickness of all structural steel members shall not be less than one-fourth ($\frac{1}{4}$) of an inch.

Chicago, March 15th, 1916.

With reference to Section 743 (h) of the Revised Building Ordinances, the Commissioner has ruled that,

(a) Whenever two or more rows of piles are required, the distance between the center lines shall not be less than the largest diameter of the piles.

(b) When a single staggered row of piles is used, the distance between the center lines shall not be less than one-half the largest diameter of the piles, except that in one-story buildings or walls less than twenty feet high a single row without any staggering may be used.

(c) The piles shall be driven so that the distance between centers shall not be less than twice the largest diameter nor two feet six inches minimum.

RULING GOVERNING THE MINIMUM THICKNESS OF METALS.**VIII.**

In steel construction exposed to the weather, no metal in principal members shall be less than 5-16 inch thick, except the webs of "I" beams or channels which may be $\frac{3}{4}$ inch thick but not less. For secondary members, no metal shall be less than 1-4 inch thick, except that webs of channels or "I" beams used as secondary members may be 3-16 inch thick, but not less. This ruling is not to apply to electric signs or fire escapes or canopies.

In steel construction protected by buildings no metal in a principal member shall be less than 1-4 inch thick, except that closed sections filled with concrete and the webs of channels and "I" beams may be 3-16 inch thick, but not less. For secondary members metal may be 3-16 inch, but not less.

The above rulings to take effect August 28 1916.

RULING ON REINFORCED CONCRETE FLOORS.**IX.**

In regard to Sec. 776 referring to fireproofing concrete floors, the Commissioner has ruled that the following interpretation shall apply to concrete joist and floor tile construction:

(a) Whenever a combination of reinforced concrete joists and hollow burned clay tile fillers is used, the same shall be assumed same as solid concrete slabs as far as fireproofing of steel rods is concerned.

(b) Whenever a system of concrete joists and steel or plaster domes instead of clay tiles is used, whether same is left in place or withdrawn afterwards, the combination shall be assumed and be subject to same re-

quirements as reinforced concrete beams and girders, with the exception that steel reinforcement in the top of the joists may be considered as in solid slab construction.

(c) Whenever cement plaster ceiling on metal lath is used in connection with the latter type of construction, one-half inch may be deducted from the required amount of fireproofing at the bottom and the sides of joists, provided that cement plaster not less than three-fourths inches thick be applied directly to the under side of joists.

RULING GOVERNING STAR-SHAPED COMPRESSION MEMBERS.

X.

In regard to columns or struts built of two angles placed back to back in star-shape, the Commissioner has ruled that the same should comply with the following specifications:

1. Star-shaped compression members shall be tied together by pairs of batten plates or pairs of angle lugs in opposite directions spaced not more than three (3) times the width of main member center to center of each successive pair.

2. Each batten plate or angle lug shall have enough rivets connecting it to each angle of the column or strut to be able to transfer fifteen (15%) per cent of total stress in the member from one angle to the other through the rivets when these are figured in single shear.

3. Minimum size of rivets shall be as follows:

$\frac{7}{8}$ " diameter for 8" angles.

$\frac{3}{4}$ " diameter for 6", 5" and 4" angles.

$\frac{5}{8}$ " diameter for 3" and 2½" angles.

4. Minimum spacing of rivets shall be three (3) inches for single row and two and one-half (2½) inches for double row, staggered, measured parallel to the gage lines. When two gage lines are used, rivets must be staggered.

5. Minimum thickness of strut angles or batten plates shall be one-fourth of an inch ($\frac{1}{4}$) when exposed to weather, and three-sixteenth (3-16) inches when protected within a building, but batten plates or angle lugs shall not be less than two-thirds (2-3) the thickness of the main compression members.

Supplementing a ruling of August 28, 1916, with regard to the minimum thickness of steel structural members, the following ruling is made. This new ruling will effect only such members as are included within the ruling itself. It being strictly understood that the members considered in this ruling shall be used nowhere in the building other than in the floor panels in connection with the construction of tile or terra cotta floors and that no such member shall be used for the support of any masonry or other structure or part thereof, that lies without the confines of a floor panel. It is further strictly understood that these members shall be attached to the principal members by bolting or riveting as per present ordinance requirements for standard members and in no other manner.

The skeleton frame of all structures shall be considered as the columns and all girders, beams, trusses, or spandrels having rigid connections to the columns. The members of floor or roof panels which have no connection to the columns, shall be considered as secondary members.

The skeleton frame and secondary members shall be designed and constructed to carry all dead, live and other loads to which they may be subjected, both during erection and after completion of the structure. All members shall be such that the developed stresses under loads which they carry can be satisfactorily determined by the analytical methods of engineering practice.

The skeleton frame shall provide all the necessary rigidity for the structure, and the

floor and roof panels shall not be considered as affecting the vertical rigidity except that in completed structures the floor and roof panel construction may be designed and considered as carrying floors and their loads to such parts of the skeleton frame as are designed to carry the horizontal forces to the foundations.

The secondary members of floor or roof panels shall be integral rolled structural steel of I Section, and may have about one-third or more the weight and section modulus of standard beams of same depth when the unit stresses and deflection do not exceed those specified in code. Secondary members shall be rigidly connected to the skeleton frame, properly supported on interior masonry walls, on shelf angles, or on the flanges of beams or girders.

Secondary members shall have a bearing of not less than 4 inches on such masonry walls and when supported on shelf angles or the flanges of beams or girders, shall extend not less than 2½ inches past the edge of the supporting member and be rigidly connected to same.

Secondary members as described shall be laterally braced at not less than six feet longitudinal intervals. The center to center spacing of secondary members in floor or roof panels shall be determined by their capacity to sustain the loads which they carry.

The unit stress in secondary members in floor or roof panels shall not exceed those provided in the building ordinances.

The above ruling to take effect April 1, 1927.

(Signed) FRANK E. DOHERTY,
Commissioner of Buildings.

CINDER FILLS ON BUILDINGS.

XI.

Cinder fill on Buildings will be figured at the rate of 66 lbs. per cubic foot unless evidence of exact weight is furnished.

PLATFORMS FOR GRAVITY TANKS.

XII.

Platform beams supporting gravity tanks shall have webs $\frac{1}{8}$ " thick or more, where the webs are inaccessible for painting the web shall be not less than $\frac{3}{8}$ " thick.

RIVETS IN TENSION.

XIII.

When rivets are used in tension in wind bracing they may be figured at 18,000 lbs. per square inch if machine driven and 15,000 lbs. per square inch if hand driven.

ROOF ARCHES OF WOOD, STEEL, REINFORCED CONCRETE, STONE OR MASONRY.

XIV.

Use the usual methods given in standard text books on elastic arches fixed or hinged at the ends, for obtaining the critical moments and shears.

The stresses shall be figured on the following basis:—

(1) For the actual dead load acting on the full span of the arch.

(2) For a vertical live load of 25 pounds per sq. ft., acting on such lengths of the arch as will give the maximum moments and shears.

(3) For a horizontal wind-load of 20 pounds per sq. ft. acting on one-half of the arch obtain the normal wind brace, Duchemin's Formula. If rollers are used under one end of arch, the wind-load shall be assumed to act on either side of the structure.

(4) For a temperature effect of 50 degrees F. above and below the average.

(5) For the actual maximum erection stresses possible.

For loadings (1), (2), (3), (4) and (5) combined or for the critical combination of these loadings the stresses given in the Ordinance may be increased (50) per cent.

Apply the ordinary Column-Formulas to the arch, considering the arch as a curved column of a length equal to $\frac{1}{2}$ the length of the arch. Do the same thing laterally, by considering the arch as a straight column of a length equal to the spacing of the struts of the lateral bracing system.

Figure the Moment stresses in the arch same as in an ordinary beam.

When rollers are used under one end of the arch, such arch shall be analyzed for a wind load acting on either side of the roof. The maximum stresses for any load or combination of loadings shall be considered.

Approved by the Commissioner of Buildings, November 8, 1921.

CONCRETE JOIST AND TILE CONSTRUCTION.

XV.

In regard to Section 776 applied to concrete joist and tile construction:

(a) When a combination of concrete joist and clay tile filler is used, it shall be assumed the same as solid concrete slab as far as fireproofing steel rods are concerned.

The top shall, for all floors and for fireproof roofs, have a minimum thickness of 2 inches, and for roofs other than fireproof a minimum thickness of $1\frac{1}{2}$ inches. The reinforcing rods perpendicular to the joists shall be spaced not more than 12-inch centers, and must contain an equivalent of $\frac{1}{4}$ round spaced 12-inch centers.

(b) When a system of concrete joist and steel or plaster domes is used, whether the domes are left in or withdrawn, the combination shall be subject to the same requirements as reinforced concrete beams and girders, except that the steel in top may be considered as in solid slab construction.

The minimum thickness of top for a fireproof floor or roof without cinder concrete over shall be $2\frac{1}{2}$ inches, and with cinder concrete or other fireproof material over shall be 2 inches. For other floors the minimum thickness shall be 2 inches, and for other roofs $1\frac{1}{2}$ inches.

When plaster ceiling either suspended or applied directly on the underside of the joists, on metal lath is used, one-half inch may be deducted from the required amount of fireproofing at the bottom and sides of the joists.

The reinforcing rods in the top perpendicular to the joists shall be spaced not more than six times the thickness of the slab and must contain an equivalent of $\frac{1}{4}$ round, spaced 12-inch centers.

(c) The thickness and reinforcing referred to above, for tops of floors, are the minimum requirements. The design must meet the necessities of the loads and spans in all respects.

This ruling to be effective until negated by the Commissioner of Buildings.

BRICK STACKS.

XVI.

The allowable extreme fibre stress in tension for brick stacks or for plain or radial terra cotta stacks shall not exceed 17.5 pounds per square inch, when laid in a mortar composed of at least one part Portland cement to one part lime and three parts sand.

Approved by the Deputy Commissioner,
ROBERT KNIGHT.

RULING FOR REINFORCED CONCRETE HOOPED COLUMNS.

XVII.

Reinforced concrete hooped columns may be used for longer lengths than twelve (12)

times the least width, provided the maximum working unit stress on the core of such axially loaded columns is determined by the formula:

$$\frac{P^1}{P} = 1.40 - \frac{L}{120 R}$$

where

P^1 = total safe axial load on long columns.

P = total safe axial load on column of the same section, whose L/D is less than 12.

R = least radius of gyration of column core.

L = unsupported length of column in inches.

D = least side of column in inches.

Approved July 29, 1924,

FRANK E. DOHERTY,
Commissioner of Buildings.

NOMENCLATURE.

XVIII.

f_s denotes unit fibre stress in steel.

f_g denotes unit fibre stress in gypsum.

E_s denotes modulus of elasticity of steel.

N_g denotes modulus of elasticity of gypsum.

n denotes ratio E_s/E_g .

M_s denotes resisting moment as determined by steel.

M_g denotes resisting moment as determined by gypsum.

M denotes bending moment in general.

b denotes breadth of tile.

d denotes distance from compressive face to the plane of the steel.

k denotes ratio of the depth of the neutral axis of a section below the top to "d."

j denotes ratio of the arm of the resisting couple to "d."

A denotes area of cross-section of steel.

p denotes steel ratio A/bd .

w denotes total uniform load per sq. ft. of tile.

STRESSES.

5"x18"x6'-0" Channel Tile.

Type "D" Mat.

One $\frac{3}{16}$ " rod each rib

Area 2—No. 7 wires=0.0492

3" rods=0.0552

Area 2— $\frac{16 A}{.1044} = 0.1044$ sq. in.

$p = \frac{bd}{18 \times 4.25} = .00136$

$n = 30$ $pn = .0408$

$k = 2 pn + (pn)^2 - pn = 0.2572$

$j = 1 - \frac{3}{k} = .9143$

$Af_sjd = \frac{1}{8} WL^2 \times 12$ For $f_s = 16000$, $w =$
 $Af_gjd = 0.1044 \times 16000 \times .9143 \times 4.25$

$W = \frac{1.5L^2}{120} = 1.5 \times 36 = 120$ lbs.

$= 80$ lbs. per sq. ft. of slab with 16000 lbs.

stress in steel.

$M = \frac{1}{8} WL^2 \times 12 = 6475$ lbs.

$f_g = \frac{2M}{2 \times 6475} = 170$ lbs.

$jk bd^2 = .9143 \times 0.2572 \times 18 \times (4.25)^2$

Shear $= \frac{120 \times 3}{3 + 2 \times 4.25 \times 2} = 16.9$ lbs. per sq. in. in rib.

For a total load of 50 lbs per sq. ft. of slab:
 $M = 1.5 \times 75 \times 36 = 4050$ lbs.

$$f_s = \frac{M}{4050} = 10000 \text{ lbs.}$$

$$f_s = \frac{Ajd}{2M} = \frac{.1044 \times .9143 \times 4.25}{2 \times 4050} = 106.5 \text{ lbs.}$$

$$f_s = \frac{jk bd^2}{75 \times 3} = \frac{.9143 \times 2572 \times 18 \times (4.25)^2}{75 \times 3} = 10.6 \text{ lbs. per sq. in. in rib.}$$

$$\text{Shear} = \frac{3 + 2 \times 4.25 \times 2}{2} = 10.6 \text{ lbs. per sq. in. in rib.}$$

2

STANDARD SPECIFICATIONS COVERING THE MANUFACTURE OF PYROBAR LONG SPAN GYPSUM ROOF TILE FOR USE IN BUILDINGS OF ORDINARY CONSTRUCTION.

Approved September 28, 1923,

By ROBERT KNIGHT

1. The gypsum used shall be second settle stucco, having an ultimate compressive value of not less than 2,000 pounds per square inch.

2. Reinforcing as indicated on sheet headed "Stresses" shall be properly placed and secured in form.

3. Thirty-seven parts by weight of water shall be added to sixty-three parts by weight of second settle stucco, the materials thoroughly mixed and poured in the form, care being taken to see that the reinforcing remains in its proper position.

4. After setting of the gypsum, the tile shall be removed from the form and placed in a kiln until thoroughly dry.

STRESSES IN THE PYROBAR LONG SPAN GYPSUM ROOF TILE SHALL NOT EXCEED VALUE GIVEN BELOW.

1. Tensile stress in steel shall not exceed one-third its elastic limit and shall not exceed 16,000 lbs. per sq. inch.

2. Shearing stress in steel shall not exceed 10,000 lbs. per square inch.

3. Direct compression in gypsum shall be one-fifth of its ultimate strength, but shall not exceed 150 lbs. per square inch. Bending in extreme fibre shall be same value as determined for direct compression.

4. Bearing of gypsum shall not exceed 200 lbs. per square inch.

5. Bond between gypsum and reinforcing steel shall not exceed the following values:
 21 lbs. per sq. in. for plain square bars.
 25 lbs. per sq. in. for plain round bars.
 30 lbs. per sq. in. for bars with mechanical bond.

6. Tension in gypsum. Gypsum is assumed not to take tension, and full reinforcement is always provided.

7. Shearing stress in plain unreinforced gypsum shall not exceed 6 lbs. per square inch. When reinforcing is provided for diagonal tension and the horizontal steel is properly anchored, the shearing stress on the gypsum may be increased to 20 lbs. per square inch.

COMPOSITION.

Physical.

Percentage of gaging water for standard consistency.

37. Dry bulk—cc's per gm. .88.

Fineness—through 100 mesh, 84.6%.

Chemical.

Percentage moisture combine water....	5.83
C & O.....	37.00
CaSO ₄	52.00
Insoluble silicates.....	3.12
Fe ₂ O ₃ Al ₂ O ₃.....	.67
CaO.....	.52
CaCO ₃ CO ₂	trace
MgO.....	.07
NaCl.....	.07

PYROBAR GYPSUM ROOF TILE. INGREDIENTS AND PROCESS OF MANUFACTURE.

Gypsum is either quarried or mined, depending upon how far below the surface the gypsum strata occurs. Gypsum is mined in much the same manner as coal. The rock is broken to one man size, then weighed and passed over a set of grates which screen out the smaller pieces. The larger pieces go through a gyratory crusher, and are crushed to what is termed "crushed rock." After leaving the crusher, the rock is run through a rotary screen where it is sized for shipment to the trade and for mill use. After delivery to the mill, it is recrushed in the swing hammer mill to about three-quarters inch size. It is then put through a rotary dryer and the surface moisture removed. The temperature in that dryer is about 150° F. This leaves the crushed gypsum bone dry and ready for grinding. The dry rock is then ground on Munson Mills to a fineness of 85%, through a 100 mesh. It is then fed into the calcining kettles to be calcined. These kettles are cylindrical in shape about 10 feet in diameter, about 15 feet high, and hold approximately twelve tons of stucco.

As the heat is applied, the gypsum commences to give up the water which is chemically combined in it. The temperature to which the gypsum in the kettle is subjected, runs about 380° F. This calcining process takes about an hour and a half, at the end of which time it gradually settles to what might be called a quiescent state. By increasing the temperature to about 450° F., the mass again comes to a boil and settles a second time. It is because of the gypsum settling in the kettle that the plaster is referred to as first or second settle stucco. In first settle stucco, about 75% of the water of crystallization is removed, and in second settle, a little more is evaporated. Second settle stucco makes a great deal denser gypsum, and is used for our long span roof tile and floor tile. First settle stucco is used for wall plaster and partition tile.

After the calcining process, the stucco is fed over the scalping screens, which automatically remove any foreign matter. It is then conveyed to the storage bin.

The second settle stucco or Structolite, as it is termed, is now ready to be made into roof tile. No foreign ingredients are added; simply water and Structolite, using 63% by weight of Structolite and 37% of water.

Ground, dry Structolite, before the water is added, weighs 65 lbs. per cubic foot, and after adding the water, the finished product weighs 77 lbs. per cubic foot.

Approved by Robert Knight, Deputy Commissioner of Buildings, September 28, 1923, for buildings of ordinary construction.

Not valid for gypsum slabs cast in place at the building.

—B. E. W

CHICAGO ZONING ORDINANCE

(Passed by the City Council of the City of Chicago on April 5, 1923; Approved by the Mayor on April 16, 1923)

AN ORDINANCE.

An Ordinance establishing a plan for dividing the City of Chicago into districts for the purpose of regulating the location of trades and industries and of buildings and structures designed for dwellings, apartment houses, trades, industries, and other specified uses, for regulating the height, volume, and size of buildings and structures, and intensity of use of lot areas, for determining building lines, and for creating a board of appeals.

Be it ordained by the City Council of the City of Chicago:

Section 1. Interpretation; Purpose. In interpreting and applying the provisions of this ordinance such provisions shall in every instance be held to be the minimum requirements adopted for the promotion of the public health, safety, comfort, morals or welfare.

Section 2. Definitions. Certain words in this ordinance are defined for the purposes thereof (unless there is express provision excluding such construction or the subject matter or context is repugnant thereto) as follows:

(a) Words used in the present tense include the future; the singular number includes the plural and the plural the singular; the word "building" includes the word "structure".

(b) **Alley**—A narrow thoroughfare upon which abut generally the rear of premises, or upon which service entrances of buildings abut, and is not generally used as a thoroughfare by both pedestrians and vehicles, or which is not used for general traffic circulation, or which is not in excess of 30 feet wide at its intersection with a street.

(c) **Apartment House**—A building which is used or intended to be used as a home or residence for two or more families living in separate apartments.

(d) **Auxiliary Use**—A use customarily incidental to and accessory to the principal use of a building or premises located on the same premises with such principal use.

(e) **Block**—A block shall be deemed to be that property abutting on a street on one side of such street and lying between the two nearest intersecting or intercepting streets, or nearest intersecting or intercepting street and railroad right of way or waterway.

(f) **Building**—A building is a structure entirely separated from any other structure by space or by walls in which there are no communicating doors or windows or similar openings.

(g) **Depth of Lot**—The depth of a lot is the mean distance from the front street line of the lot to its rear line measured in the general direction of the side lines of the lot.

(h) **Dwelling House**—A building used or

intended to be used as a home or residence in which all living rooms are accessible to each other from within the building and in which such living rooms are accessible without using an entrance vestibule, stairway or hallway that is designed as a common entrance vestibule or common stairway or common hallway for more than one family, and in which the use and management of all sleeping quarters, all appliances for cooking, ventilating, heating, or lighting, other than a public or community service, are under one control.

(i) **Family**—One or more individuals living, sleeping, cooking and eating on the premises as a single housekeeping unit.

(j) **Grade**—The finished grade of premises improved by a building is the elevation of the surface of the ground adjoining the building. The established grade of premises whether vacant or improved is the elevation of the sidewalk at the property line as fixed by the City. Where the finished grade is below the level of the established grade, the established grade shall be used for all purposes of this ordinance.

(k) **Garage**—A public garage, except as otherwise provided by this paragraph, is a building or premises arranged, designed, and intended to be used for the storage of motor vehicles for hire or reward, or which does not come within the definition of a private or community garage as herein set forth. A private garage is a building with ground area not in excess of 80 square feet arranged, designed, and intended to be used for the storage on the ground floor of not more than 4 individually owned passenger automobiles devoted to the private use of the owner, when such garage is located on the same premises, as an auxiliary use, with the residence or apartment or business of the owner of such automobiles so stored, and where no fuel is sold. A use as a private stable shall be subject to the same ground area regulations for the purposes of this ordinance as the regulations controlling the ground area of a private garage. Where two or more separate private garages, each having a ground area not in excess of 200 square feet, are located on the rear half of the premises, not more than one of such garages having a vehicle entrance on a public street, such garages collectively shall be deemed a community garage, but a group of two or more private garages on a single lot not so located or arranged or any one of which is in excess of 200 square feet in area shall be deemed a public garage.

(l) **Height of Building**—The height of a building shall be the vertical distance measured in the case of flat roofs from the mean level of the established grade to the level of the highest point of the under side of the ceiling beams adjacent to the street, and in the case of a pitched roof from such grade to the mean height level of the under side of

the rafters of the gable. Where a block has a frontage on a two-level street the upper street level may be used to determine the height of buildings for a distance back from such frontage not in excess of one-half the depth of the block at right angles to such frontage, but not farther back than the alley most nearly parallel to such street in any case. Where a structure is set back from the street line, the mean level of the finished grade of the premises along the line of that part of the structure nearest the street line may be substituted for the established grade for the purpose of determining the height of a building. Where no roof beams exist or there are structures wholly or partly above the roof, the height shall be measured from the established grade or finished grade to the level of the highest point of the building.

Note: See amendment to Section 21, paragraph E.

(m) **Lot**—A parcel of land or premises occupied, or which it is contemplated shall be occupied, by one building with its usual auxiliary buildings or uses customarily incident to it, including such open spaces as are required by this ordinance and such open spaces as are arranged and designed to be used in connection with such building, shall be deemed a lot for the purposes of this ordinance. A corner lot shall be deemed to be that property which has an area not in excess of 8,000 square feet, and which abuts on two streets making an angle on the lot side of not greater than 120 degrees.

(n) **Non-conforming Use**—A non-conforming use is a use which does not comply with the regulations of the use district in which it is situated.

(o) **Public Space**—A park, public square, or submerged land under the jurisdiction of a park district shall be deemed a public space.

(p) **Street**—A thoroughfare used for public foot and vehicle traffic other than an alley as herein defined, shall be deemed a street.

(q) **Street Line**—The street line is the dividing line between a street and the lot. The front street line shall be deemed to be the shortest street line.

(r) **Street Wall**—The street wall, for the purposes of this ordinance, shall be deemed that wall or part of a wall of a building, or that part of the wall of a porch or other structure, nearest to and most nearly parallel with the street, extending more than 4 feet 6 inches above the finished grade.

(s) **Volume of Building**—The volume of a building shall be the contents in cubic feet of that space between the grade used in determining the height of buildings and the mean level of the roof (except as otherwise specifically provided by Section 16, Paragraph (a),) including scenery, lofts and other storage spaces, cooling towers, elevator bulkheads, towers, penthouses, water tanks or water towers, dormers, bays, covered ways, covered porches or other spaces not open to the sky, and courts, provided that certain courts or certain parts thereof opening on thoroughfare or public spaces, cornices projecting beyond the exterior walls, piers or columns, or the space under the projection of a cornice, chimneys, parapet walls, structures extending into thoroughfares or public spaces, architectural finials or open framework wireless towers shall not be included as a part of the volume of a building. No court except an open court unobstructed from the street or alley or other public place by walls for its full width shall be excluded from the volume of a building. An offset court opening on an open court but having a wall between the offset court and the thoroughfare or public place, or that part of a court not open to the sky, shall not be within the definition of an open court or of a part of an open court. The distance between the mean level of the top of the enclosing walls of the court and the mean level of the bottom of the court

shall be used to determine the volume of such court.

Section 3. **Use of Districts.** For the purpose of classifying regulating and restricting the location of trades and industries and the location of buildings designed for specified industrial, business, residential, and other uses, the City of Chicago is hereby divided into four classes of districts: (1) Residence districts, (2) Apartment districts, (3) Commercial districts, and (4) Manufacturing districts; as shown on the use district map which accompanies this ordinance. The said use district map, consisting of forty-nine separate parts all of which are sections of the same map covering the entire territory of the City, the volume district map, also containing forty-nine parts each of which relates to the corresponding part of the use district map, and the index map and chart containing the explanation of symbols and indications which appear on said use district and said volume district maps, are hereby made a part of this ordinance. The use districts designated on said map are hereby established. No building shall be erected nor shall buildings or premises be used for any purpose other than a purpose permitted by this ordinance in the use district in which such building or premises is or are located.

Section 4. **Residence Districts.** (a) In a Residence district no building or premises shall be used nor shall a building be erected, altered, or enlarged which is arranged, intended, or designed to be used for an A, C, or M use as defined hereinafter. In a Residence district no building or premises shall be used nor shall any building be erected, altered, or enlarged which is arranged, intended, or designed to be used except for R uses or special uses exclusively as hereinafter provided.

(b) For the purposes of this ordinance, R uses are hereby defined as uses designed for and permitted in Residence districts and conforming to the provisions relating to such districts; and all R uses are classified as R1, R2, R3, or R4 uses as follows:

R1 Use—An R1 use shall include every use as a dwelling house.

R2 Use—An R2 use shall include every use as golf or tennis grounds or similar use, church, convent, parish house, public recreation building, community center building, music school, university, public school, juvenile dancing school, or a private or boarding school or college unless such private or boarding school or college is operated so as to bring it within the definition of a C use.

R3 Use—An R3 use shall include every use as a public park, public playground, or railway passenger station.

R4 Use—An R4 use shall include every use as a tree or plant nursery, farm, truck garden, greenhouse (unless such greenhouse is operated as a retail business), and a railway right of way not including yard tracks or industrial tracks.

Section 5. **R Use Limitations.** In a Residence district no building shall be erected or used and no building shall be erected which is arranged, intended, or designed for an R2 use unless such building or use is located—

On premises adjoining a street under the jurisdiction of a park district;

On premises adjoining or across a street or alley from a railway right of way;

On premises on the same street and adjoining premises or directly across a street from premises where there exists a building devoted to an R2 or R3 or special use as hereinafter defined;

On corner premises diagonally or directly across a street from premises upon which is maintained an R2 or R3 or special use;

On premises entirely surrounded by streets or alleys;

On premises three sides of which adjoin streets;

On premises adjoining or immediately across a street from an Apartment, Commercial or Manufacturing district;

On premises adjoining on the same street premises where there exists a building devoted to a non-conforming use;

On premises already devoted to an R2 or R3 or special use; or

On premises located in a block in which there are no premises devoted to dwelling house purposes.

Section 6. Apartment Districts. (a) In an Apartment district no building or premises shall be used nor shall a building be erected, altered, or enlarged which is arranged, intended, or designed to be used for a C or M use as defined hereinafter. In an Apartment district no building or premises shall be used nor shall any building be erected, altered, or enlarged which is arranged, intended, or designed to be used except for R or A uses or special uses exclusively as hereinafter provided.

(b) For the purposes of this ordinance, A uses are hereby defined as uses other than R uses, designed for and permitted in Apartment districts and conforming to the provisions relating to such districts; and all A uses are classified as A1, A2, or A3 uses as follows:

A1 Use—An A1 use shall include every use as an apartment house.

A2 Use—An A2 use shall include every use as a boarding house, lodging house, or a hotel which is maintained within the limitations in Apartment districts imposed thereon by this ordinance.

A3 Use—An A3 use shall include every use as a public library, public museum, public art gallery, hospital or sanitarium, an eleemosynary institution except as otherwise classified, or a private club excepting a club the chief activity of which is a service customarily carried on as a business.

Section 7. Auxiliary Uses in Residence or Apartment Districts. (a) Auxiliary uses which do not alter the character of the premises in respect to their use for residential purposes shall be permitted in Residence and Apartment districts. Auxiliary uses shall include the following, but the enumeration of such cases shall not be deemed to prevent proper auxiliary uses that are not referred to:

Signs advertising the premises for sale or for rent which are located (if space occupied by buildings does not prevent) not nearer to adjoining premises than 8 feet or nearer to a street line than the building line established by this ordinance;

The office of a surgeon, physician or dentist, located in the dwelling or apartment used as the private residence of such surgeon, physician or dentist;

Customary home occupation located in a dwelling, studio, or apartment and carried on only by the members of the household of the person occupying such dwelling, studio, or apartment as his private residence, provided no window or other display or sign is used to advertise such occupation;

The renting of one or more rooms or the providing of table board in a dwelling or apartment occupied as a private residence, provided no window or other display or sign is used to advertise such use;

A public dining room or restaurant located in a hotel provided that the public entrance to such dining room or restaurant is from the lobby of the hotel, and further provided that no window or other display or sign is used to advertise such use;

Such facilities or retail shops as are required for the operation of a hotel or apartment house, or for the use or entertainment of guests or tenants of the hotel or apartment house, when conducted and entered only from within the building; provided no street window or other exterior display or other exterior sign is used to advertise such use; and further provided that in an apartment district which is also in a 4th or 5th volume district, at any time after ten years from the time of the passage of this ordinance but not previously (and no construction shall be given to the following language which would permit the uses therein named or any of

them before the expiration of said ten year period), an auxiliary use shall be deemed to include a retail shop on the ground floor of an apartment house or hotel (which apartment house or hotel is not less in height than 120 feet), such shop having a store front with show windows on and an entrance from a street, with such signs only as are on the glass of said window or entrance door; provided, however, that no such retail shop, such store front or entrance, or such sign shall be used for any purpose or business (1) which is not suitable to the neighborhood and to the main occupancy of said apartment house or hotel, (2) which involves the trucking of material through the abutting or adjacent streets or alleys in sufficient quantities to produce undue congestion in such streets or alleys or to interfere with the usual functioning of those streets or alleys, or (3) which is of such character as an automobile or automobile tire or accessory business, or heavy machinery display or sales room, garage, meat market, bakery, grocery store, hardware store, ice cream parlor, soda water fountain, gasoline filling station, street front lunch room or cafeteria, undertaking establishment, laundry, amusement place, or any other use of an objectionable character; and the specific enumeration above of certain uses shall not be held to exclude other uses which are unsuited to the neighborhood although not specifically enumerated.

Private dining halls, dormitories, printing presses, students' laboratories or workshops, playgrounds, athletic fields, or other customary facilities in connection with an R2 use;

A news or refreshment stand or restaurant in connection with a passenger station;

Recreation and service buildings in a public park or public playground;

A private garage or private stable in connection with an R use, limited in ground area to 10 per cent of the area of the lot, but not in excess of the ground area prescribed for or in excess of the capacity limits of a private garage; provided, however, that a private garage or private stable in connection with an R use shall not be located on the same lot with another private garage or private stable or community garage;

A private garage or private stable or community garage in connection with an A use in an Apartment district, limited in ground area to 15 per cent of the area of the lot, provided that a community garage auxiliary to an A1 use shall not be composed of a greater number of private garages than the number of separate dwelling apartments located on the same lot.

(b) Auxiliary uses shall not include:

A garage or stable in connection with a non-conforming use except a private garage or private stable whose ground area does not exceed 10 per cent of the area of the lot;

A driveway or walk used for access to a C or M use;

A billboard, signboard or advertising sign, store, trade, business, garage or stable, except such as are hereinbefore specifically permitted.

Section 8. Commercial Districts. (a) In a Commercial district no building or premises shall be used nor shall a building be erected, altered, or enlarged which is arranged, intended, or designed to be used for M uses as defined hereinafter. In a Commercial district no building or premises shall be used nor shall any building be erected, altered, or enlarged which is arranged, intended, or designed to be used except for R, A, or C uses or special uses exclusively as hereinafter provided.

(b) For the purposes of this ordinance, C uses are hereby defined as uses other than R and A uses, designed for and permitted in Commercial districts, and conforming to the provisions relating to such districts; and all C uses are further defined and classified as C1, C2, or C3 uses as follows:

C1 Use—A C1 use shall include every use as

Airplane hangar or airplane repair shop;
Amusement park or pier, skating rink, baseball park, or race track, if such park or pier, rink, baseball park, or track is operated as a business for purposes of private profit;
Armory or arsenal, except where ammunition is manufactured;

Automobile repair shop, automobile parts or tire repair or vulcanizing shop, public garage, automobile fuel or service station;

Advertising sign;

Convention hall;

Driveway or walk used for access to any C or M use;

Financial institution;

Greenhouse operated as a retail business;

Internal combustion engine operated in connection with any use permitted in a Commercial district, provided such engine is equipped and operated only with a competent muffling device;

Office;

Public or private institution, except an institution otherwise classified;

Railroad or water freight station, or storage, team, loading or unloading track or private track, or wharf; provided that the handling of materials, products, or articles at such station, track, or wharf shall be subject to the same limitation and restrictions as apply to the district in which the station, track, or wharf is located;

Restaurant, laundry, theatre, dance hall, billiard room or bowling alley, if such restaurant, laundry, theatre, dance hall, billiard room or bowling alley is operated as a business for purposes of private profit.

As amended July 25, 1927, and further amended July 11, 1928.

Retail store, retail trade, vocation, profession, or shop for custom work or the making of articles to be sold at retail on the premises to the ultimate consumer, storage in warehouse of materials or products permitted as a C2 use; provided the operation of such store, trade, vocation, profession, shop, or storage does not involve the handling of materials, products, or articles across the public sidewalks in sufficient or considerable amounts so as to interfere with the free, safe, and continuous passage of pedestrians along such walks; and provided such store, trade, vocation, profession, shop, or storage does not involve the handling or trucking of materials, products, or articles, through the abutting or adjacent streets or alleys in sufficient quantities as to produce undue congestion in such streets and alleys or interfere with the usual functioning of those streets or alleys;

School for dancing except as hereinbefore classified, trade or vocational school other than an M use, horseback riding school;

Wholesale sales office or sample room;

Provided the operation of any such specified use is not offensive or noxious by reason of the emission of odors, fumes or gases, dust, smoke, noise or vibrations.

C2 Use—A C2 use shall include all uses not otherwise classified, provided all materials and products are stored and all manufacturing operations are carried on entirely within substantial buildings completely enclosed with walls and roof, and provided no operations are of such a nature as to become offensive or noxious to the occupants of adjoining residence or apartment uses by reason of the emission of odors, fumes or gases, dust, smoke, noise, or vibrations; and C2 uses shall include such uses as

Carpet cleaning, provided no dust is permitted to escape from the building;

Cigars, cigarettes, or smoking tobacco manufacturing;

Clay or glass products manufacturing, decorating, or assembling, provided no individual kiln capacity exceeds 200 cubic feet and no kiln is fired except by oil, gas, or electricity;

Cotton, wool, flax, hair, hemp, leather, felt, paper, cardboard, cork, rubber, fur, feathers, horn, bone, shell, celluloid, fiber articles or products manufacturing, or the manufacturing

of articles or products from similar materials, but not including uses otherwise classified;

Felt manufacturing, provided no dust is permitted to escape from the building;

Ink manufacturing, not including the preparation of linseed or resin oils;

Lumber sawing, planing, dressing, shaping, pressing, turning, bending, carving, assembling, including carpenter shop for any kind of repairing or manufacturing except as otherwise classified whether or not the product is sold at retail on the premises;

Metal planing, shaping, bending, grinding, milling, drilling, die sinking, forging (except an M use), coring, punching, stamping, pressing, soldering, welding, riveting (other than snap riveting), buffing, polishing, or finishing, plating, galvanizing, sherardizing, tempering, annealing, hardening, other than by processes or operations which emit odor or noise of a disagreeable or annoying nature for the manufacturing of metal products; casting of aluminum, babbitt, brass, bronze, iron, lead white metal for the manufacture of metal products, provided no metals are melted except in melting pot the capacity of which does not exceed 500 pounds or in electric furnace the capacity of which does not exceed 500 pounds, and further provided no pneumatic chippers are employed; assembling, not including an M2 or M3 use, of metal products or parts, or of metal assembled with other materials, except by processes or operations which emit noise of a disagreeable or annoying nature; sheet metal, tin, copper, brass workers' shop, plumbing shop, wagon shop, or machine shop, whether or not the product or service is sold at retail on the premises;

Painting, enameling, japanning, lacquering, oiling, staining, or varnishing shop, whether or not the product or service is sold at retail on the premises;

Pharmaceutical products, toilet preparations, patent or proprietary medicines, or baking powder manufacturing, provided no toxic or corrosive fumes, offensive odors or dust are permitted to escape from the building;

Rubber products manufacturing from Para, plantation or non-ill-smelling African rubbers in which sulphur chloride is not used;

Shoddy or shoddy felt manufacturing, provided no dust is permitted to escape from the building;

Storage of such materials or products as acids, bark, broom corn, cotton, chemicals, clothing, drugs, dry goods, eggs, farm products, feed, food products, fruits, furniture, glass, groceries, hardware, hemp, hops, household goods, ice, junk, jute, liquors machinery metals, millinery, naval or ship stores, paint, paper, pipes, plaster, produce, rags roofing materials, rice, rope, rubber, scenery, shop or mill supplies sugar, tobacco, textiles, vegetable fibre such as hemp, jute or others not specifically mentioned, waste paper, wines, wood; storage in underground tanks of oils, petroleum or inflammable fluids in quantities and under conditions permitted by other ordinances;

Wholesale produce salesroom or market;

Wholesale, packing, repacking, labeling, consigning or storage warehouse; also

Every use, packing, finishing, or storage, or any legal use not otherwise classified, if conducted wholly within a building generally occupied by more than one manufacturing use and customarily called a loft building, without serious annoyance or injury to other usual occupants of the same building and without affecting by reason of noxious odors, fumes or gases, or excessive dust, noise, vibration, or danger, a business or other use or activity which is customarily carried on or may be carried on wholly within the same loft building with the C2 use or which may be conducted on adjacent premises.

C3 Use—A C3 use shall include, provided all materials and products are stored and all

manufacturing operations are carried on entirely within substantial buildings completely enclosed with walls and roof, and provided no operations are of such a nature as to become offensive or noxious to the occupants of adjoining premises devoted to or adapted for other uses, by reason of the emission of odors, fumes or gases, dust, smoke, noise, or vibrations, the following uses:

Brewery;

Cement products such as concrete blocks, pipe, garden furniture manufacturing;

Custom dyeing or cleaning, clothes cleaning, steam cleaning;

Distilled liquors or spirits manufacturing except an M use;

Feed manufacturing, except from refuse, offal or tankage;

Food products, beverages, confections manufacturing, preparation, compounding, baking, canning, packing, or bottling, including the grinding, cooking, roasting, preserving, drying, smoking, or curing of meats, fruits, or vegetables, except a C1 use or a use otherwise classified;

Fuel distributing station (except a C1 use) from which fuel is sold at retail and where all fuel is unloaded from carriers and loaded upon carriers and stored entirely within substantial enclosed buildings, provided the operation of said station is carried on without the emission of dust or noise;

Ice manufacturing for purposes of sale;

Milk or ice distributing station from which truck or wagon deliveries are customarily made;

Poultry killing, packing, or storage for purposes of sale at wholesale;

Paint or enamel blending, including all operations except operations which are M uses or other processes from which offensive or noxious odors, gases or fumes escape from the building;

Soap manufacturing from refined oils or fats, provided competent condensers or other appliances shall be operated where necessary to comply with the definition or the intended definition of a C3 use, and excepting the use of low grade greases, oils or tallow or other ingredients which emit noxious odors;

Stable for the housing of more than 8 horses or cows, livery or boarding or sales stable.

Section 9. Auxiliary Uses in Commercial Districts. (a) Auxiliary uses shall be permitted in a Commercial district. An auxiliary use to a C1 or C2 use shall not include a stable for the housing of more than 8 horses or cows or a livery or boarding stable.

(b) An auxiliary use in a Commercial district shall include an M1 storage use as hereinafter defined, provided such M1 storage use shall not occupy in excess of 50 per cent of that part of any premises wholly within a Commercial district, nor shall such M1 storage use be located nearer to a Residence or Apartment district than 50 feet, and further provided that such M1 use shall not be located nearer to a street upon which the C use abuts than 50 feet where a Manufacturing district does not adjoin the same street in the same block or in a block directly across the street from the C use, but an auxiliary M1 use shall in any case be permitted in that part of a Commercial district within 50 feet of a railroad right of way other than a street railway.

(c) An auxiliary use shall not include an M1 use other than storage, nor an M2 or M3 use as hereinafter defined.

Section 10. C Use Limitation. (a) A C1 use shall not include a C2 or C3 use. A C2 use shall not include a C3 use.

(b) No C2 use which is not auxiliary to and incidental to a C1 use, if such C2 use is located in that part of a Commercial district which is nearer at any point to a Residence or Apartment district than 125 feet, shall be operated between the hours of 8 P. M. and 6 A. M., if such operation involves the trucking or hauling of materials or products dur-

ing such hours or if such operation involves processes of a nature such as to disturb the occupants of said Residence or Apartment districts between the hours of 8 P. M. and 6 A. M.

(c) No C2 use or part thereof, except a storage warehouse or more than one of such uses collectively or individually, together with auxiliary uses thereto, shall be established on more than one-half of the total floor space of a building located in that part of a Commercial district which is nearer than 125 feet at any point to a Residence or Apartment district, but floor space equal to the ground area of any premises in such part of a Commercial district may be occupied by C2 uses in any case although in excess of the said one-half; and such part of a Commercial district located within 135 feet of a railroad right of way other than a street railway, or located adjoining or across a street or across an alley from a Commercial district which is not restricted by the provisions of this paragraph or from a Manufacturing district, shall be exempt from the floor space restrictions of this paragraph. That portion of a building or premises wholly within such part of a Commercial district shall be deemed a separate building or separate premises for the purpose of determining the areas limited by the provisions of this paragraph.

(d) No C3 use or part thereof, together with auxiliary uses thereto, shall be established in that part of a Commercial district which is nearer at any point to a Residence district or Apartment district than 125 feet.

(e) No opening in the side or rear wall or roof of a public garage shall be nearer to the boundary line of a Residence or Apartment district than 16 feet.

Section 11. Manufacturing Districts. (a) In a Manufacturing district no building or premises shall be used nor shall a building be erected, altered, or enlarged which is arranged, intended, or designed to be devoted to a use prohibited in the City of Chicago by any other ordinance. In a Manufacturing district no building or premises shall be used nor shall any building be erected, altered, or enlarged which is arranged, intended, or designed to be used except for R, A, C, or M uses or special uses exclusively as hereinafter provided.

(b) For the purpose of this ordinance, an M use is hereby defined as any use for an occupation, business or activity other than an R, A, or C use, that may lawfully be carried on within the city and shall include every lawful use except an R, A, or C, or special use. All M uses are further defined and classified as M1, M2, or M3 uses as follows:

M1 Use—An M1 use shall include such storage, manufacturing or other uses of property coming within the definition of an M use as do not injuriously affect the occupants of adjacent uses and are so operated that they do not emit dust, gas, smoke, noise, fumes, odors, or vibrations of a disagreeable or annoying nature.

An M1 storage use shall include such uses as

Above ground tanks for the storage of oils, petroleum or other inflammable fluids in quantities not greater than 3,000 cubic feet, except as prohibited or otherwise regulated by other ordinances;

Wholesale lumber yard, retail or mill lumber yard; wood yard; the storage in bulk or in yard or in shed of such products or materials as articles manufactured or in the process of manufacture (except as otherwise classified), asphalt, bark, barrels, boxes, brick, cement, cord wood, cotton, contractor's equipment, crates, creosoted products, gravel, iron, junk, lime, machinery, pipe, plaster, rags, roofing, sand, scrap iron, scrap paper, stone, tar, terra cotta, timber, vehicles; or the stor-

age of any other products or materials which do not emit dust, gas or odors of a disagreeable or annoying nature.

An M1 use, provided such use does not customarily emit dust, gas, smoke, noise, fumes, odors, or vibrations which may be offensive or noxious to the adjacent R or A or C uses and does not injure the operation of adjacent C or M uses, shall include also every such use as

Bleaching and dying of yarns, textiles, or felt in case sulphur colors or materials which create offensive odors are not used.

As amended July 25, 1927, and further amended July 11, 1928.

Chalk, graphite, emery, corundum, carborundum, whiting, mercury salts, white lead, red lead, zinc salts, lithopone, plaster, pumice, or talc products manufacturing from the dry materials, or the manufacturing of products from other dust producing materials; provided no operation is contrary to the general definition of an M1 use;

Clay, glass, or shale products manufacturing except a C2 use, including the refining or blending of the raw materials;

Crematory except a crematory located in a cemetery;

Fabricating, other than snap riveting or processes used in bending and shaping of metal which emit noises of a disagreeable or annoying nature, for assembling metal products; forging of metals, melting, casting of metals or manufacturing of steel or alloys of steel from iron, provided no cupola is employed; and further provided no operation is contrary to the general definition of an M1 use;

Paper or strawboard manufacturing from waste paper stock or pulp board;

Railroad freight, storage or classification yard; railroad shop or roundhouse;

Stone, marble or granite grinding, dressing, or cutting; provided no operation is contrary to the general definition of an M1 use;

Varnish or enamel manufacturing from balsam gums, copal, or spar and turpentine, alcohol or benzene and other ingredients which do not emit disagreeable or noxious fumes or gases;

Or any use not otherwise classified which is not contrary to the general definition of an M1 use and not contrary to the classification of such uses herein made.

M2 Use—An M2 use shall include the uses set forth hereunder, provided such use does not customarily emit dust which is not controlled by competent dust collecting appliances, or such use is one which from the nature of the materials handled or processes customarily employed, emits dust, gas, smoke, noise, fumes, or odors, to such an extent as to affect the health, safety, comfort, morals or welfare of occupants of R or A or C uses located not farther than 400 feet from the M2 use, and which use does not customarily emit corrosive or tarnishing gases or fumes which injure C or M uses distant 100 feet or more from the M2 use, or which does not create vibrations to an extent that would damage buildings or affect the position or alignment of machinery erected with usual permanency on premises distant 100 feet or more from the M2 use; in which classification, subject to the conditions named, is every such use as

Bone grinding from soft bone;

Carpet beating or cleaning;

Chalk, graphite, emery, corundum, carborundum, whiting, mercury salts, white lead, red lead, zinc salts, lithopone, plaster, pumice or talc products manufacturing from the dry materials, or the manufacturing of products from other dust producing materials;

Chewing tobacco or snuff manufacturing;

Coffee roasting or manufacturing of coffee substitutes where roasting of cereals is done;

Dyes manufacturing from coal tar derivatives;

Emery, corundum or carborundum, graphite products manufacturing by the employment of grinding processes;

Foundry compound or parting sand manufacturing;

Fuel gas or illuminating gas manufacture or purification;

Fuel gas or illuminating gas storage or the storage above ground of other inflammable fluids except as otherwise classified;

Fuel pocket, tippie, trestle, dump or yard, wholesale or retail, other than a C3 use;

Grain elevator;

Grease, lard, fat, or tallow rendering or refining, except from refuse or rancid fats;

Linseed oil, or similar oils, manufacturing, boiling, or refining;

Lithopone manufacturing;

Live stock corrals or pens, stock yards;

Metal fabricating processes or the assembling of materials where snap riveting is done, or where processes creating noises permitted in the general definition of an M2 use are carried on, for the manufacturing of such products as locomotive or power plant boilers or similar boilers; cranes, dredges, derricks, excavating buckets, locomotives, railroad and electric cars, ships, steel and wood cars, steel truck bodies; structural and reinforcing steel for buildings, bridges, ships and other structures; wire fence, wire lath and reinforcing wire; forging, melting, heating or casting of metals or their alloys, employing all processes, except a use otherwise classified, for the manufacturing of such products as armor plate, automobile or wagon springs, brake shoes, cast iron pipe, cast iron safes, drop forgings, furnaces, ingot-molds, iron or steel billets, plates, sheets, structural shapes, rails, tubes, molding machinery, railroad car wheels, axles, or springs;

Nail, tack or rivet manufacturing where heading or cutting machines are employed;

Operation of internal combustion engines without competent muffling devices;

Paper manufacturing, except as otherwise classified;

Planing mill;

Plaster or plaster of Paris manufacturing;

Pumice stone grinding or refining;

Rubber products manufacturing from Para, plantation or non-ill-smelling African rubbers, in which sulphur chloride is used;

Sausage casings, gut strings or similar products manufacturing;

Sewage purification by Imhoff, activated sludge or similar processes;

Shellac refining;

Slaughtering;

Shoddy or shoddy felt manufacturing;

Soap manufacturing, except a use otherwise classified;

Soya bean oil, or china wood oil manufacturing or refining;

Stone crushing and screening; stone grinding, cutting or buffing not otherwise classified; stone quarry;

Varnish or enamel manufacturing if animal glues or shellac are used as ingredients of the varnish or enamel;

Vinegar or yeast manufacturing;

White lead or red lead manufacturing; whiting manufacturing;

Or any use not otherwise classified or which is not contrary to the general character of M2 uses as indicated by the classification herein contained and the conditions imposed.

M3 Use—An M3 use shall include all M uses which are excluded from the M1 and M2 classification; including every such use as:

Animal black, bone black or lamp black manufacturing;

Asphalt manufacturing or refining; asphalt or similar preservative coating or impregnation of fibre materials or wood where heat is applied;

Cattle or sheep dip manufacturing;

Chlorine or bleaching powder manufacturing; electrolysis of brine;

Coal distillation, including derivation of such products as gas, ammonia, or coal tar;

Coal tar, refuse grain, fermented refuse grain, bones or wood distillation;

Cottonseed oil, or similar oils, manufacturing, boiling or refining;

Creosote manufacturing or refining;

Dyeing of yarn, textiles, or felt, except a use otherwise classified;

Fertilizer manufacturing from organic matter or minerals;

Fish curing, cooking, smoking or canning; fish oil manufacturing or refining;

Glue, size or gelatine manufacturing, where the processes include the refining or recovery of products from fish or animal refuse or offal;

Grain drying or poultry feed manufacturing from refuse mash from breweries or from refuse grain;

Gypsum refining;

Hydrochloric, nitric, sulphuric, or sulphurous acid manufacturing;

Incineration, drying, or reduction or storage, of garbage, offal, refuse, dead animals or other refuse;

Lime kiln;

Ore or slag pile or dock;

Petroleum or kerosene refining or distillation or derivation of by-products;

Portland, slag, or natural cement manufacturing;

Rubber products manufacturing from or the refining of ill-smelling African or similar rubbers;

Slaughter house refuse, or other refuse, or rancid fats, or refuse dead animals, cooking, boiling, or rendering;

Smelting or refining of such metals or their alloys as aluminum, iron, lead, steel, tin, zinc, from the ores;

Starch, dextrine, or glucose manufacturing; sugar refining;

Tanning of hides or pelts, also storage, curing or cleaning of raw hides or pelts;

Wool scouring, washing of hair from tanneries, or from slaughter houses; washing of feathers or similar operations;

Or any other use that is lawful within the city, which would be harmful by reason of dust, gas, smoke, noise, fumes, odors, vibrations, soot, sudden fire or explosion or any other causes to a use otherwise classified at a distance of 2,000 feet or more from the M3 use; provided the uses set forth hereunder are not contrary to the provisions of any other ordinance of the City of Chicago.

Section 12. M Use Limitations. (a) An M1 use shall not include an M2 or M3 use and shall not be classified as an M1 use if such M2 or M3 use is present; an M2 use likewise shall not include an M3 use.

(b) No M2 use shall be established nearer to a Residence or Apartment district than 400 feet nor nearer to a Commercial district than 125 feet.

(c) An M3 use shall not be established nearer to a Residence, Apartment or Commercial district than a distance at which the M3 use would not from any cause be offensive or noxious to the occupants of such Residence, Apartment or Commercial district, but the distance of an M3 use from a Commercial district shall not be less than 500 feet nor shall the distance from a Residence or Apartment district be in any case less than 2,000 feet.

Section 13. Special Uses. (a) For the purposes of this ordinance all special uses are classified as follows:

Airdrome;

Street car barn;

Cemetery;

Circus, carnival, carousal, open air or tent show or similar use, operated for purposes of private profit;

Hospital or sanitarium for the care of contagious diseases or incurable patients;

Institution for the care of the insane or feeble-minded;

Penal or correctional institution;

Police or fire station;

Public service water reservoir, filtration plant, or pumping station;

Public service or institutional light, heat or power plant except auxiliary use;

Public utility gas plant, electric station or substation;

Telephone exchange.

(b) A special use or the extension of an existing special use may be located in any district without restriction as to the distance from any other district, provided such location or such extension will not seriously injure the appropriate use of neighboring property.

Section 14. Non-conforming Uses. (a) A non-conforming use existing at the time of the passage of this ordinance may be continued.

(b) A non-conforming use shall not be extended, but the extension of a use to any portion of a building which was arranged or designed for such non-conforming use at the time of the passage of this ordinance shall not be deemed the extension of a non-conforming use.

(c) A building other than an A3 use arranged, designed or devoted to a non-conforming use at the time of the passage of this ordinance may not be reconstructed or structurally altered to an extent exceeding in aggregate cost, during any ten-year period, 50 per cent of the value of the building unless the use of such building is changed to a conforming use.

(d) A non-conforming A3 use may be enlarged or extended within the limitations of the volume district in which it is located.

(e) A non-conforming yard storage use shall not be expanded in area of storage space so used.

(f) A non-conforming advertising sign use if removed from the premises may not be replaced.

(g) A non-conforming use shall not be changed unless changed to a more restricted use; provided, however, that in a Residence district an M use shall not be changed unless changed to a conforming use.

(h) A non-conforming use if changed to conforming use shall not thereafter be changed back to any non-conforming use.

(i) A non-conforming use if changed to a more restricted non-conforming use shall not thereafter be changed unless to a still more restricted use.

(j) In a Residence district an A1 use shall not be changed to an A2 use.

(k) In a Manufacturing district no existing M use shall be deemed to be non-conforming except where such use is nearer at the time of the passage of this ordinance to a Residence or Apartment or Commercial district, as the case may be, than the minimum distance as prescribed by this ordinance.

(l) For the purposes of this ordinance a use shall be deemed to be changed if changed from a use included in a use class to a use not included in such class.

(m) A non-conforming use except as hereinbefore provided shall be deemed to be changed to a more restricted use if the use to which such non-conforming use is changed is a use included in a use class that in the arrangement of classes precedes the class in which such non-conforming use is included. The classes shall be deemed to be arranged in order of precedence as R, A, C1, C2, C3, M1, M2 and M3, as hereinbefore defined.

Section 14A. It shall be unlawful for any person, firm or corporation to carry on or engage in the business of keeping a junk store or a junk yard upon any street in the city upon which is located a street railway line.

Section 15. Size of Building. For the purpose of regulating and limiting the height and bulk of buildings hereafter to be erected, of regulating and limiting the intensity of the use of lot areas, and of regulating and determining the area of open spaces within and surrounding such buildings, the City of Chicago is hereby divided into five classes of districts: 1st Volume district, 2nd Volume

district, 3rd Volume district, 4th Volume district and 5th Volume district, as shown on the volume district map which accompanies this ordinance, such volume district map being referred to in Section 3, and by said Section 3 made a part of this ordinance. The volume districts designated on said map are hereby established. No building or part of a building shall be erected except in conformity with the regulations herein prescribed for the volume district in which said building is located. No lot area shall be so reduced or diminished nor shall a building be so enlarged that the volume of the building shall be greater or the open spaces shall be smaller than hereinafter prescribed. The open spaces required for a particular building shall not be included as a part of the required lot or yard areas of any other building.

Section 16. 1st Volume District. In a 1st Volume district, (except as provided by Section 21 of this ordinance):

(a) No building, except a building in a Commercial or Manufacturing district, shall occupy more than 50 per cent of the area of a lot if an interior lot or 65 per cent if a corner lot, exclusive of the area hereinbefore provided for a garage, and the aggregate volume in cubic feet of all buildings on a lot exclusive of the volume of certain attic spaces or spaces above the ceiling level of the story next below the roof and exclusive of the ground story of a garage shall not exceed the area of the lot in square feet multiplied by 10 feet where the lot is not a corner lot, or by 13 feet in the case of a corner lot, or by 36 feet in a Commercial or Manufacturing district; provided that 2/10 feet but not more than a total of 2 feet in any case shall be added to the 10 feet or to the 13 feet for each 100 square feet that the lot of record prior to the date of the passage of this ordinance in a Residence or Apartment district is less in area than 3,600 square feet. Attic space, space above the ceiling level of the story next below the roof of a building or any part of a building, space above the enclosing walls of a church or auditorium, or room or that part thereof contained wholly within the roof space above the level of the enclosing wall or walls, may be enclosed in addition to the volume of a building, provided the cubic content of such space or room or such part thereof is not in excess of the cubic content of the space which would be enclosed by a hip roof making angles of 60 degrees with the horizontal springing from a horizontal plane on the enclosing walls or part thereof of such building, church, or auditorium;

(b) At any street line no building or part thereof shall exceed a height of 33 feet. For each 1 foot that a building or portion of it sets back from any street line, such building or such portion thereof may be erected 2 feet in height in excess of 33 feet. No part of a building shall be erected to a height at any point in excess of 66 feet;

(c) For each 1 foot that a building or portion of it is distant from the center line of an alley, such building or such portion thereof may be erected 3 feet in height. No building or portion thereof shall be erected nearer the center line of an alley than 8 feet;

(d) For each 1 foot that a building or portion of it sets back from all lines of adjacent premises, such building or such portion thereof may be erected 3 feet in height in excess of 30 feet, provided that along lines of adjacent premises in a 2nd Volume district the setback regulation required along lines of adjacent premises in a 2nd Volume district shall apply, and further provided that along the lines of adjacent premises in a 3rd or 4th or 5th Volume district no setback shall be required. For the purpose of this paragraph the height of a building shall be the mean level of the top of a parapet wall or the mean level of the top of the structure. Chimneys are exempt from the provisions of this paragraph.

Section 17. 2nd Volume District. In a 2nd volume district (except as provided by Section 21 of this ordinance):

(a) Located within a Residence or Apartment district no building shall occupy more than 60 per cent of the area of a lot if an interior lot or 75 per cent if a corner lot, exclusive of the area hereinbefore provided for a garage, and the aggregate volume in cubic feet of all buildings on a lot exclusive of the ground story of a garage shall not exceed the area of the lot in square feet multiplied by 40 feet, or by 50 feet in the case of a corner lot, except that 1 per cent but not more than a total of 5 per cent shall be added to the 60 per cent or 75 per cent respectively for each 100 square feet that the lot of record prior to the date of the passage of this ordinance is less in area than 3,600 square feet;

(b) Located within a Commercial or Manufacturing district the aggregate volume in cubic feet of all buildings on a lot shall not exceed the area of the lot in square feet multiplied by 72 feet.

(c) At any street line no building or any part thereof shall exceed a height of 66 feet. For each 1 foot that a building or portion of it sets back from any street line, such building or portion thereof may be erected 2 feet in height in excess of 66 feet. No part of a building shall be erected to a height at any point in excess of 132 feet;

(d) For each 1 foot that a building or portion of it is distant from the center line of any alley, such building or such portion thereof may be erected 5 feet in height and no building or portion thereof shall be erected nearer to the center line of an alley than 8 feet; provided these regulations shall not be applied along that part of an alley for the 55 feet of its length nearest the street which the alley intersects;

(e) Located within a Residence or Apartment district for each 1 foot that a building or portion of it sets back from any line of adjacent premises, such building or such portion thereof may be erected 3 feet in height in excess of 44 feet, provided that along lines of adjacent premises in a 3rd or 4th or 5th Volume district, this setback regulation shall not be required. Chimneys are exempt from the provisions of this paragraph.

Section 18. 3rd Volume District. In a 3rd Volume district (except as provided by Section 21 of this ordinance):

(a) Located within a Residence or Apartment district no building shall occupy more than 75 per cent of the area of a lot if an interior lot or 90 per cent if a corner lot, exclusive of the area hereinbefore provided for a garage, and the aggregate volume in cubic feet of all buildings on a lot exclusive of the ground story of a garage shall not exceed the area of the lot in square feet multiplied by 100 feet, or by 120 feet in the case of a corner lot;

(b) Located within a Commercial or Manufacturing district the aggregate volume in cubic feet of all buildings on a lot shall not exceed the area of the lot in square feet multiplied by 144 feet;

(c) At any street line no building or part thereof shall exceed a height of 132 feet. For each 1 foot that a building or portion of it sets back from any street line, such building or such portion thereof may be erected 2 feet in height in excess of 132 feet. No part of a building shall be erected to a height at any point in excess of 198 feet;

(d) For each 1 foot that a building or portion of it is distant from the center line of any alley, such building or such portion thereof may be erected 7 feet in height and no building or portion thereof shall be erected nearer to the center line of an alley than 8 feet, provided these regulations shall not be applied along that part of an alley for the

55 feet of its length nearest the established building line on the street which the alley intersects.

Section 19. 4th Volume District. In a 4th Volume district (except as provided by Section 21 of this ordinance):

(a) The aggregate volume in cubic feet of all buildings on a lot shall not exceed the area of the lot in square feet multiplied by 216 feet, or by 240 feet in the case of a corner lot which is located also in a Residence or Apartment district; in a Residence or Apartment district the area provisions of Section 18, paragraph (a) shall apply;

(b) At any street line no building or part thereof shall exceed a height of 198 feet. For each 1 foot that a building or portion of it sets back from any street line, such building or such portion thereof may be erected 3 feet in height in excess of 198 feet. No part of a building shall be erected to a height in excess of 264 feet;

(c) For each 1 foot that a building or portion of it is distant from the center line of any alley, such building or such portion thereof may be erected 9 feet in height, provided this regulation shall not be applied along that part of an alley for the 55 feet of its length nearest the street which the alley intersects;

Section 20. 5th Volume District. In a 5th Volume district (except as provided by Section 21 of this ordinance):

(a) No building or part thereof shall be erected to a height at any street line or alley line in excess of 264 feet, provided, however, that back from the street line or alley line such building or part thereof may be erected so as not to protrude above a plane sloping up at an angle of 30 degrees with the horizontal from such street line or alley line at the height limit a distance from such street line or alley line of 32 feet measured on the slope. The height of such sloping plane shall be the ultimate height of the structure. In a Residence district or Apartment district the area provisions of Section 18, paragraph (a) shall apply;

(b) For each 1 foot that a building or portion of it is distant from the center line of any alley, such building or such portion thereof may be erected 10 feet in height, provided this regulation shall not be applied along that part of an alley for the 55 feet of its length nearest the street which the alley intersects.

Section 21. General Volume District Provisions.

(a) Where all parts of a cornice of any building or structure are more than 12 feet above the grade as defined in Section 2, paragraph (1) and below a height of 120 feet in a 3rd Volume district or below 186 feet in a 4th Volume district or below 252 feet in a 5th Volume district, and where such cornice extends in whole or in part along the street frontage of a building and where the return of such cornice, if any, along an alley wall is not longer than a distance equal to the width of the alley, such cornice may project into the street a distance of 5 feet and into the alley a distance of 3 feet, but for each 1 foot above the height of 120 feet or 186 feet or 252 feet in the 3rd or 4th or 5th Volume districts respectively, the projection of the cornice shall be reduced 3 per cent of the prescribed 5 feet or 3 feet until a projection of 2 feet shall have been reached. Above the height of a parapet as provided for by paragraph (b) of this section, no part of a structure shall project into a street or alley a greater distance than 2 feet.

(b) Nothing in this ordinance shall prevent the erection above the street line height limit of such structural members as are required to support the roof, or a parapet wall or cornice solely for ornament and without windows, extending above such height limit not more than 5 per cent of such height, but such parapet wall or cornice may in any case be at least 5½ feet high but shall not be

higher than 8 feet above such height limit.

(c) Nothing in this ordinance shall prevent the erection in a Manufacturing or Commercial district, above the height and in excess of the volume as provided by this ordinance of grain elevators, conveyors, derricks, gas holders, or other necessary appurtenances to manufacturing or storage operations in connection therewith.

(d) In a 1st or 2nd Volume district which is also in a Commercial or Manufacturing district, or in a 3rd, 4th or 5th Volume district; if the area of a building is reduced so that above the street line height limit it covers in the aggregate not more than 25 per cent of the area of the premises, the building above such height shall be excepted from the volume and street line height limit regulations. The aggregate volume in cubic feet of all such portions of the building shall not exceed one-sixth of the volume of the building as permitted by this ordinance on the premises upon which such portions are erected; provided that for each 1 per cent of the width of the lot on the street line that the street wall above the street line height limit is greater in length than 50 per cent of the width of the lot, such wall shall be erected not nearer to such street line than 1 foot; and further provided that for each 10 feet in height that any such portion of the building is erected above the street line height limit, such portion of the building shall be set back 1 foot from all lines of adjacent premises. For purposes of this paragraph, the permitted volume of a building in the 5th Volume district shall be the cubic contents of the space which may be occupied under the provisions of Section 20 of this ordinance.

(e) The street line height limit in a 2nd, 3rd, or 4th Volume district shall be increased 33-1/3 per cent of such height limit on that frontage of premises which abuts on a street greater in width than 120 feet, or on that frontage of premises directly across the street from a public park, public playground, public waterway, or cemetery, or railroad right of way other than a street railway. The same increase in the street line height limit shall apply to the frontage on a street which intersects or intercepts such street or park or playground or waterway or cemetery or railroad right of way for a distance from such street or park or playground or waterway or cemetery or railroad right of way equal to the depth of the lot under one ownership at the time of the passage of this ordinance but not beyond the boundary of the volume district which that part of the frontage of the lot is in (1) which abuts on a street greater in width than 120 feet, or (2) which is directly across the street from such park, playground, waterway, cemetery, or right of way, in any case. But the provisions of this paragraph shall not be so construed as to increase the ultimate height limit or the volume limit as provided by this ordinance.

Section 21, Paragraph E, Sub-Paragraph 1. The street line height limit in a Fifth Volume District shall be increased 66 2/3% of such height limit on all frontages of premises three (3) sides of which adjoins streets, one of which sides abuts a street greater in width than 100 feet, and one of which sides is across the street from a public park, public playground, public waterway, or cemetery, it being the intention of the provisions of this paragraph to increase the ultimate height limit of said described premises.

Passed June 14, 1929, p. 557 C. P.

Repealed Oct. 17, 1929.

(f) In a 3rd, 4th or 5th Volume district which is also in an Apartment district, the entire ground area of the lot up to an ultimate height of 30 feet may be occupied, provided such space shall be used only as a waiting room, lobby, or lounging room or auditorium or service rooms, auxiliary to an R2 or A use, and further provided that the volume as permitted by this ordinance shall

not be increased and further provided that the provisions of Section 22 shall take precedence over all provisions of this paragraph.

(g) Nothing in this ordinance shall prevent the erection above the street line height limit, of spires in connection with an R2 use.

(h) Where premises in one volume district are directly across an alley from a less restricted volume district, all the regulations prescribed by this ordinance pertaining to the distance of a building or part thereof from the center line of an alley for that less restricted district shall be applied to such premises.

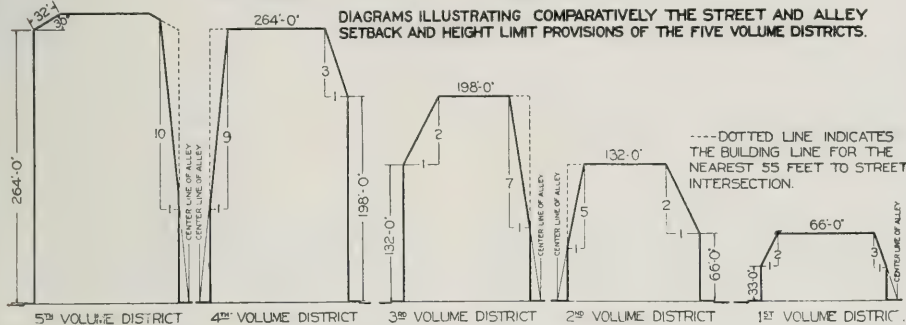
(i) Where premises or any portion thereof abut on an alley which also adjoins a

(j) A fire escape as required by other ordinances of the City of Chicago, fire-proof outside stairway or solid floor balcony to a fire tower if projected not more than 4 feet into a court or yard, the ordinary projections of window sills, belt courses, if such projections do not exceed 6 inches, shall not be deemed to reduce the area or volume of open spaces. Cornices or similar ornamental features projecting not over 4 feet into courts which open on a street or alley shall not be deemed to reduce the area or volume of open spaces for the purpose of determining the volume of a building.

(k) Where a lot greater in area than 8,000 square feet, located in a Residence or Apart-

THESE DIAGRAMS ARE NOT PART OF THE CHICAGO ZONING ORDINANCE

DIAGRAMS ILLUSTRATING COMPARATIVELY THE STREET AND ALLEY SETBACK AND HEIGHT LIMIT PROVISIONS OF THE FIVE VOLUME DISTRICTS.



railroad right of way, public park, playground or cemetery, or which abut on the end of what is commonly known as a blind alley, the provisions pertaining to distance of a building or part thereof from the center line of an alley shall not apply for such premises or such portion thereof.

ment district abuts on two intersecting streets at their intersection, the area and volume of the building as permitted by this ordinance may be distributed over the lot.

(l) The provisions of Section 22 shall take precedence over the area provisions of all Volume district sections of this ordinance.

Volume Districts	Use Districts	Lot	Occupancy of lot in per cent of lot area	Volume of building, area of lot times	1 ft. setback from side lot lines for each 3 ft. above	Height limit at street line in feet	1 ft. setback from street line above height limit for added height of	1 ft. setback from center line of alley at grade for height of	Ultimate height of building in feet	No building nearer the center line of alley than
1st	Res. or Apt. Res. or Apt. Com. or Mfg.	Interior Corner	50 65 100	10 (D) 13 (D) 36 (D)	30 ft. (G)	33 (F)	2 ft.	3 ft.	66 (K)	8 ft.
2nd	Res. or Apt. Res. or Apt. Com. or Mfg.	Interior Corner	60 (B) 75 (B) 100	40 50 72	44 ft. (G) None	66 (F)	2 ft.	5 ft. (L)	132 (K)	8 ft. (M)
3rd	Res. or Apt. Res. or Apt. Com. or Mfg.	Interior Corner	75 90 100	100 120 144	None	132 (F)	2 ft.	7 ft. (L)	198 (K)	8 ft. (M)
4th			100	216	None	198 (F)	3 ft.	9 ft. (L)	264 (K)	
5th			100	No Volume Provision	None	264	(H)	10 ft. (L)	(H) (K)	

NOTES.

(Not a part of the ordinance.)

A—Corner lot maximum area 8,000 square feet.

B—1% (maximum 5%) may be added to the 60% or 75% of the area in a 2nd Volume Residence or Apartment district for each 100 square feet that the lot is less in area than 3,600 square feet.

C—Private or community garage 1 story not included in area or volume limits in 1st, 2nd or 3rd Volume Residence or Apartment districts.

D—Volume of a building includes courts not open to a street or alley; in a 1st Volume district space under a pitched roof (equal in volume to a 60 degree hip roof) may be erected in addition to Volume; 2/10 foot (maximum 2 feet) may be added to Volume factors of 10 feet and 13 feet in a 1st Volume Residence or Apartment district for each 100 square feet that the lot is in area than 3,600 square feet.

E—Height limit at street line is to under side of ceiling beams; parapet (maximum height 8 feet) may be added.

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F—Street line height limit may be relaxed where frontage is on a public space.

G—Side lot line set back height limit is to the mean level of the top of fire wall; at a district boundary the least restrictive rule applies.

H—In a 5th Volume district the slope up from the street and alley lines above 264 feet is 30 degrees, for a distance of 32 feet up the slope.

I—Cornices with 5 feet projection are permitted (3 feet projection in an alley back from the street a distance equal to the width of the alley) to a height 20 feet below the height limit of the parapet; for each 1 foot above that height the cornices are reduced in projection 3%.

J—Grain elevators, derricks, gas tanks, etc., are allowed above height limit in a 1st, 2nd or 3rd Volume manufacturing use.

K—Towers in 1st and 2nd Volume commercial or manufacturing districts and in 3rd, 4th or 5th Volume districts. (See paragraph (d) Section 21.)

L—Alley set back in a 2nd, 3rd, 4th or 5th Volume district does not apply for nearest 55 feet to the street which the alley intersects.

M—Distance of buildings from center line of alleys in a 2nd or 3rd Volume district does not apply for nearest 55 feet to the street which the alley intersects.

Section 22. Building Lines. (a) For the purpose of preventing the obstruction to light and air for adjoining premises in Residence and Apartment districts by establishing building lines along the street frontage, no building shall be erected or altered in a Residence or Apartment district which is also in a 1st, 2nd or 3rd volume district or as provided by paragraph (e) of this section in a Commercial district, except in such a manner as to conform to the provisions of this section.

(b) In a Residence district no building shall be erected whose street wall is nearer the front street line than a distance equal to 15 per cent of the average depth of the lots in a block except as hereinafter provided. In an Apartment district no building shall be erected whose street wall is nearer to the front street line than a distance equal to 10 per cent of the average depth of the lots in a block except as hereinafter provided.

(c) Where a block is occupied or partially occupied by buildings which existed in the block at the time of the passage of this ordinance, the average of the distances from the street line of the front street walls of buildings shall be the established building line; but where this average distance does not exceed 10 feet in a block in which the street wall of any existing building is nearer along the front line to the street than 5 feet the street wall may be erected at the street line. Lots occupied by buildings designed for residence uses permitted in a Residence district, unless the aggregate frontage of such lots exceeds 50 per cent of the total frontage in the block, shall be considered as though vacant where located in an Apartment district for the purpose of establishing the building line.

(d) For the purpose of computing the average of the distances of street walls of buildings from the street line, the street wall nearest the street shall be considered as though it were continuous across the entire lot frontage and such average shall be based upon units of lot frontage, but buildings whose street walls are distant from the street line in excess of the provisions of paragraph (b) of this section shall be deemed to exactly conform to the provisions of paragraph (b), and existing auxiliary buildings, temporary buildings, fences, advertising signs, retaining walls, steps, balustrades, or similar existing structures shall not be considered in computing such average.

(e) Along the side of a corner lot in a Residence district or Apartment district which is not known as the front line and which generally is the side having the greatest dimension along a street line and which side line is in the same block with a lot or lots whose street line is the front line, no building shall be erected whose street wall is nearer the street at the rear end of such line than the established building line in the block and for each 1 foot that the building or part thereof is distant from the adjoining lot line exclusive of the width of an intervening alley, if any, such building or such part thereof may be erected 1 foot nearer to the street line. The provisions of this paragraph shall apply to a Commercial dis-

trict which is also in a 1st or 2nd Volume district and which is in the same block with a Residence district or Apartment district.

(f) Where a lot adjoins premises, the street wall line of which is unrestricted or less restricted by this section, the street wall line of such lot for that 75 per cent of the lot frontage nearest to such unrestricted or less restricted street wall line but not in excess of 30 feet in any case, may conform to the provisions of this section as they apply to such unrestricted or less restricted street wall which it adjoins.

(g) Where any existing building erected prior to the time of the passage of this ordinance has its street wall nearer to the street line than the building line as established by this section, then the street wall of any building erected or altered on that 75 per cent of the frontage not in excess of 30 feet of the adjacent lot which immediately adjoins the lot occupied by such existing building may approach not nearer the street line than the street wall of such existing building.

(h) Cornices, belt courses, an entrance canopy or similar roofed space having not more than 20 square feet of horizontal area covered by roof for each 25 feet of lot frontage, porches or bays projecting not more than 3 feet 6 inches exclusive of cornice and having an aggregate volume at any story not in excess of 35 per cent of the area of that part of the street wall of a building at such story multiplied by $3\frac{1}{2}$ feet, and steps and landings below the level of the first floor, and their balustrades and open fences or railings or similar structures hereafter erected, provided such fences or railings or structures do not obstruct vision to an extent in excess of 40 per cent above a height of 4 feet 6 inches above the established grade, shall be exempt from the restrictions provided by this section.

(i) The premises of each building, with its usual auxiliary buildings, existing at the time of the passage of this ordinance, or premises or part thereof which may hereafter be occupied by buildings, or additions to existing buildings, shall be deemed a lot for the purposes of this section. Lots separated by an alley shall be deemed to be adjoining. All measured distances shall be to the nearest integral foot. If the fraction is $\frac{1}{2}$ foot or less the integral foot next below shall be taken.

Section 23. District Boundaries. (a) Whenever a portion of any district is indicated upon the use or volume district map as a strip paralleling an opened or unopened street, the width of this strip, unless delimited on the map by dimensions, lot lines, alleys, railroad or elevated railway rights of way, or otherwise, shall be assumed to be 125 feet measured at right angles from the nearest street line of the street to which it is parallel and adjacent.

(b) The district boundaries are, unless otherwise indicated, either street lines or lines drawn parallel to and 125 feet back from one or more of the street lines bounding a block. Where two or more district designations are shown within a block 250 feet or less in width the boundary of the less restricted district shall be deemed 125 feet



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back from its street line. Where two or more district designations are shown within a block more than 250 feet in width the boundary of the more restricted district shall be deemed 125 feet back from its street line.

(c) Where the street layout actually on the ground varies from the street layout as shown on the use or volume district map, the designation shown on the mapped street shall be applied to the unmapped streets in such a way as to carry out the manifest intent and purpose of the plan for the particular section in question.

(d) Where a district boundary line as defined in this section or as shown on the use or volume district map divides a lot in single ownership at the time of the passage of this ordinance, the use or volume authorized on the least restricted portion of such lot shall be construed as extending to the entire lot, provided this does not extend more than 25 feet beyond the said boundary line of the district in which such use is authorized. The use or volume so extended shall be deemed to be conforming.

(e) The space above the surface of streets, alleys or waterways are to be regarded merely as explanatory of the maps and shall not be deemed to be a part of the use district to which it is adjacent.

(f) Submerged lands which may hereafter be reclaimed, unless otherwise indicated on the use or volume district maps, shall be deemed to be in the same use and volume district as premises not now submerged to which such submerged lands are contiguous.

(g) Areas on the use and volume district maps along the margin of such maps outside of the border line streets are to be regarded merely as explanatory of the maps and shall not be considered as indicating the use or volume indicated thereon.

Section 24. Completion and Restoration of Existing Buildings. Nothing herein contained shall require any change in the plans, construction or intended use of a building for which a building permit has been heretofore issued and the construction of which shall have been diligently prosecuted within one year of the date of such permit, and the ground story of which, including the second tier of beams shall have been completed within such year, and which entire building shall be completed according to such plans as filed within three years from the date of the passage of this ordinance; provided the time shall be extended for not to exceed one year, or in cases where one such extension may have been granted the time shall be further extended for one year within which such ground story framework, including the second tier of beams shall be completed in any case where actual construction or fabrication was begun early enough to allow, under the then existing conditions, adequate time for completion as above specified and where such construction or fabrication was diligently prosecuted and where such completion has been prevented by conditions impossible to foresee and beyond the control of the owner or builder. Nothing in this ordinance shall prevent the restoration of a building or an advertising sign destroyed by fire, explosion, act of God or act of the public enemy, not in excess of 50 per cent of the value of the building, or prevent the continuance of the use of such building or part thereof as such use existed at the time of such destruction of such building or part thereof or prevent a change of such existing use under the limitations as hereinbefore provided.

Section 25. Administration. This ordinance shall be enforced by the Commissioner of Buildings. The Commissioner of Buildings is hereby empowered and it shall be his duty to administer this ordinance in conjunction with the administration of such portions of the general ordinances of the City of Chicago as are commonly designated as the building code of the City of Chicago in such a manner as to facilitate their joint administration. For the purpose of enforcing this ordinance the authority vested in him under the said

building code is hereby declared to be vested in him under this ordinance.

Section 26. Certificates of Occupancy. (a) It shall be unlawful to use or permit the use of any building or premises or part thereof, hereafter created, erected, changed or converted wholly or partly in its use or structure, until a certificate of occupancy, to the effect that the building or premises or the part thereof so created, erected, changed or converted, and the proposed use thereof, conform to the provisions of this ordinance, shall have been issued by the Commissioner of Buildings. No change or extension of use and no alterations shall be made in a non-conforming use or premises without a certificate of occupancy having first been issued by the Commissioner of Buildings that such change, extension or alteration is in conformity with the provisions of this ordinance.

(b) Certificates of occupancy shall be applied for at the same time that the building permit is applied for and shall be issued within 10 days after the erection or alteration of the building shall have been completed. A record of all certificates shall be kept on file in the office of the Commissioner of Buildings and copies shall be furnished upon request to any persons having a proprietary or tenancy interest in the building affected.

(c) Pending the issuance of a regular certificate, a temporary certificate of occupancy may be issued for a period not exceeding six months, during the completion of alterations or during partial occupancy of a building pending its completion. Such temporary certificates shall not be construed as in any way altering the respective rights, duties or obligations of the owners or of the city relating to the use or occupation of the premises or any other matter covered by this ordinance, and such temporary certificate shall not be issued except under such restrictions and provisions as will adequately insure the safety of the occupants. No temporary certificate shall be issued if prior to its completion the building fails to conform to the provisions of the building code or of this ordinance to such a degree as to render it unsafe for the occupancy proposed.

Section 27. Plats. Each application for a build permit shall be accompanied by a plat in duplicate, drawn to scale and in such form as may be prescribed by the Commissioner of Buildings, showing the actual dimensions of the lot to be built upon, the size of the building to be erected, and such other information as may be necessary to provide for the enforcement of the regulations contained in this ordinance. A careful record of such applications and plats shall be kept in the office of the Commissioner of Buildings.

Section 28. Board of Appeals. A board of appeals is hereby established. The members of the board of appeals shall be appointed by the Mayor, subject to confirmation of the City Council. The board of appeals shall consist of five members. One of said members shall be an architect who has had 10 years' experience in the practice of his profession, one shall be a structural engineer who has had 10 years' experience in the practice of his profession, another shall have had 10 years' experience as a builder, and still another shall have had 10 years' experience as a real estate dealer. The chairman shall be designated by the Mayor. The board of appeals shall keep minutes of its proceedings showing the vote of each member on every question, or if absent or failing to vote indicating such fact. The board of appeals in its rules shall fix the time for regular meetings of the board. Special meetings may be called by the chairman or at the request of two members, provided that notice of the same shall be mailed to each member at least 24 hours before the time set, except that the announcement of a special meeting at any meeting at which all members are present shall be sufficient notice of such meeting. All meetings shall be open to the public. A quorum of the

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board of appeals shall consist of three members. A majority of the members present at each meeting shall control its official actions. The members of the board shall attend meetings in person.

Note—By an amendment to the Enabling Act August 8, 1924, (Smith-Hurd, Illinois Revised Statutes, 1923, Chapter 24, Zoning) enacted since the passage of the zoning ordinance, the Board of Appeals is given power to grant variations without action by the City Council. The same amendment provides also that Council may pass amendments to the zoning ordinance without the approval of the Board of Appeals.

The provisions of the revised statute take precedent over Section 29 of the Zoning Ordinance where there is conflict.

Section 29. Functions of the Board of Appeals. (a) The board of appeals shall adopt from time to time such rules and regulations as it may deem necessary to interpret and to carry into effect the provisions of this ordinance, and shall recommend to the City Council such ordinances or amendments as it may deem necessary or desirable to carry into effect the provisions of this ordinance or to modify the same. Variations from or amendments to this ordinance shall in all cases be made by ordinance. The regulations imposed and the districts created under this ordinance may be varied or amended from time to time by ordinance, but no such variations or amendments shall be made without a hearing before the board of appeals, at which persons interested shall be afforded an opportunity to be heard. Notice of such hearing shall be published at least 15 days in advance thereof in a newspaper of general circulation in Chicago. Such notice shall state the time and place of the hearing and the place where copies of the proposed varying or amending ordinance will be accessible for examination by interested parties. Such hearing may be adjourned from time to time. Within 30 days in cases of amendments and five days in cases of variations after the final adjournment of such hearing the board of appeals shall make a final report and submit a proposed ordinance to the City Council. The City Council may enact the ordinance with or without change or may refer it back to the board of appeals for further consideration. Any proposed variation or amendment which fails to receive the approval of the board of appeals shall not be passed, except by the favorable vote of two-thirds of all the members of the City Council.

(b) **Amendments.** In case of written protest against any proposed amendment signed and acknowledged by the owners of 20 per cent of the frontage proposed to be altered, or by the owners of 20 per cent of the frontage immediately adjoining or across an alley therefrom, or by the owners of 20 per cent of the frontage directly opposite the frontage proposed to be altered as to such regulations or district, filed with the said board of appeals or with the City Council, such amendment shall not be passed, except by the favorable vote of two-thirds of all the members of the City Council. If any area is hereafter transferred to another district by a change in district boundaries by an amendment, as above provided, the provisions of this ordinance in regard to buildings or premises existing at the time of the passage of this ordinance shall apply to buildings or premises existing at the time of passage of such amendment in such transferred area.

(c) **Variations.** Upon application such board of appeals shall have power to review the action of the enforcing officer of the City of Chicago in order to determine whether it is in accordance with the terms of this ordinance. Where in specific cases of applications for permits there are practical difficulties or particular hardship in the way of carrying out the strict letter of the provisions of this ordinance the board of appeals shall have power upon application to recommend variations of or from the original or

ordinance or amendments thereto.

(d) Variations in specific cases of practical difficulties or particular hardship shall include the following, but the enumeration of such cases shall not be deemed to prevent the recommendation of other proper variations:

(1) Granting of permission to devote premises in a Residence or Apartment district to a nonconforming A use or C use, except a billboard, in a block or in a block directly across a street from a block, in which there exists a non-conforming A use or C use respectively of a similar nature, provided that such permission shall not be so exercised as to permit either such use of premises in blocks where no such use existed at the time of the passage of this ordinance on either side of the street, and further provided that a non-conforming use herein permitted shall not exceed in area of premises or cubical contents of structures of the similar non-conforming use then existing. In granting such permission the building line regulation provided by this ordinance for the block shall be maintained, and the use permitted shall be deemed to be non-conforming in the same sense as though it were erected prior to the time of the passage of this ordinance.

(2) The extension of a non-conforming use or building upon the lot occupied by such use or building at the time of the passage of this ordinance. The erection of an additional building upon a lot occupied at the time of the passage of this ordinance by a business or industrial establishment in case such additional building is a part of such establishment, when carrying out the strict letter of the provisions would result in practical difficulties or extreme and unnecessary hardship.

(3) In undeveloped sections of the city the issuance of temporary and conditional permits for not more than two years for structures and uses in contravention of the use regulations controlling Residence districts; provided such cases are important to the development of such undeveloped sections and also provided such uses are not prejudicial to the adjoining and neighboring sections already developed.

(4) In a Residence district the location of an R2 use contrary to the provisions of Section 5, provided the R2 use will not injure neighboring property for dwelling house purposes.

(5) In a 1st, 2nd or 3rd Volume district, the moderate relaxation of the area or volume provisions of Section 16, 17 or 18 for the erection of a building for an R2 or A3 use where the premises to be devoted to such use were acquired prior to the time of the passage of this ordinance.

(6) Variation in the application of Section 10 or Section 14 in a Commercial district or part thereof in blocks adjoining the city limits of Chicago or on premises across the street from blocks in which the limitations provided by Section 10 do not apply or in neighborhoods where uses existing at the time of the passage of this ordinance are contrary to the provisions of such section or where by reason of amendment to the ordinance the said district or part thereof comes to be within 125 feet of a Residence or Apartment district, taking into consideration the conditions then existing in the blocks affected by the amendment.

(7) Variation in the application of Section 12 or Section 14 in a Manufacturing district or part thereof in locations where uses existing at the time of the passage of this ordinance are contrary to the provisions of such sections or when by reason of amendment to this ordinance any part of the then existing M2 or M3 uses in such district or part thereof come to be nearer to a Residence or Apartment or Commercial district than permitted by Section 12.

(8) Permission to maintain an M2 or M3 use anywhere in a Manufacturing district which otherwise would not be permitted by this ordinance where clearly the appropriate



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use of neighboring property is not injured thereby.

(9) Variation of the area or volume provisions of this ordinance in a block where there exists a structure which exceeds the area or volume requirements respectively of this ordinance, provided, however, that such variation shall not be construed to permit the erection of a structure in excess of the area or volume of such existing structure.

(10) In a Residence or Apartment district where lots are irregular in shape or where obviously no building line is required by reason of the peculiar conditions, or where all light is obtained from public spaces, variation of the area requirements of this ordinance and in such cases a proportionate variation in volume.

(11) Variation in the definition of the height of building where a building is erected with a frontage on a public waterway or on a natural hillside, but such variation shall be made only for the purpose of adjusting the height limits so as to conform with that of neighboring structures.

(12) Variation in the height of buildings regulations for the purpose of permitting the erection of additional stories to an existing building where it can be shown that the erection of such additional stories was contemplated, and where the original foundations were designed to carry such additional stories.

(13) Granting of permission in an Apartment district which is also in a 2nd, 3rd, 4th or 5th volume district to occupy space on the lot in addition to the area or volume permitted by Sections 17, 18, 19 or 20, of this ordinance, provided such additional space shall occupy lower floors only and further provided that such additional space shall be used only as a waiting room, lobby or lounging room or auditorium or service rooms auxiliary to an R2 or A use. In granting such permission the building line regulations provided by this ordinance for the block shall be maintained, but the volume permitted by this ordinance may be correspondingly increased.

(14) Alteration or relaxation of the provisions of Section 22, or to the extent necessary to prevent undue or peculiar hardship where in any block or portion of a block there are lots not of uniform depths, or irregular shapes or peculiar proportions, forms or topography, or fronting on more than one street, or where any frontage less in length than 100 feet has adjoining it on each side permanently less restricted frontage, or when clearly the general purpose and intent thereof will be better served thereby.

(15) Where owners of all properties in a block petition in writing for the establishment of a building line within that block, which building line is less restrictive than that which would otherwise be established by the provisions of Section 22, the alteration of the building line proposed by the petitioners.

(16) In a Residence or Apartment district the location of a special use as defined by Section 13 or the extension of an existing special use provided such location or such extension will not seriously injure the appropriate use of neighboring property, and further provided that the location of an air-drome shall be consistent with regulations, ordinances and laws then existing to control navigation of the air.

(17) Where a district boundary line divides a lot in single ownership at the time of the passage of this ordinance, the extension of the use or volume authorized on the least restricted portion of such lot over the entire lot, provided this does not extend more than 100 feet beyond the boundary line of the district in which the use is authorized.

Section 30. Violations and Penalties. For any and every violation of the provisions of this ordinance, the owner, general agent or contractor of a building or premises where such violation has been committed or shall

exist, and the lessee or tenant of an entire building or entire premises where such violation has been committed or shall exist, and the owner, general agent, contractor, lessee or tenant of any part of a building or premises in which part such violation has been committed or shall exist, and the general agent, architect, builder, contractor or any person who commits, takes part in or assists in such violation or who maintains any building or premises in which any such violations shall exist, shall for each and every violation and for each and every day or part thereof that such violation continues, be subject to a fine of not more than \$200.00. Any person violating the provisions of this ordinance by pursuing a C or M1 use which without operation of approved nuisance prevention equipment or without certain nuisance eliminating processes or methods of operation would be classified as an M2 or M3 use, or an M2 use which without such equipment, processes or methods would be classified as an M3 use, shall be deemed to have committed a separate violation of this ordinance for each day or part thereof that such C or M1 or M2 use is operated in such a manner as to violate the manifest purpose and intent of the definition of a C or M1 or of an M2 use respectively, and each complete unit of equipment shall be deemed a separate use for the purposes of this paragraph and shall be subject to the same penalty as provided herein. Legal remedies for violations shall be had and violations shall be prosecuted in the same manner as is prescribed by law or ordinance for the prosecution of violations of other ordinances, effective in the City of Chicago.

Section 31. Remedies. In case any building or structure is erected, constructed, reconstructed, altered, repaired, converted, or maintained, or any building, structure or land is used, in violation of this ordinance or any other ordinance or lawful regulation, the proper authorities of the City of Chicago, in addition to the remedies herein provided for may institute any appropriate action or proceeding to prevent such unlawful erection, construction, reconstruction, alteration, repair, conversion, maintenance or use, or to impose a penalty for such violation, or to restrain, correct or abate such violation, in order to prevent the occupancy of said building, structure or land contrary to the provisions hereof, or to prevent any illegal act, conduct, business or use in or about such premises.

Section 32. Validity of Ordinance. If any section, paragraph subdivision, clause, sentence or provision of this ordinance shall be adjudged by any court of competent jurisdiction to be invalid, such judgment shall not affect, impair, invalidate or nullify the remainder of this ordinance but the effect thereof shall be confined to the section, paragraph, subdivision, clause, sentence or provision immediately involved in the controversy in which such judgment or decree shall be rendered.

Section 33. Effect on Present Ordinances. This ordinance shall not be construed as repealing or modifying any valid ordinances of the City of Chicago now in effect which restrict the location of industries, entertainments, occupations, establishments or enterprises of any kind, either by requiring frontage consents from property owners or residents affected by such location, or by prohibiting or restricting the location of same within a fixed distance from a hospital, church, public school or parochial school, or the grounds thereof, or on or near any class of streets or boulevards or any parks, playgrounds or bathing beaches. As to all other ordinances or parts of ordinances in conflict with any of the provisions of this ordinance, the same are hereby repealed.

Section 34. When Effective. This ordinance shall take effect and be in force from and after its passage, approval and due publication.

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DEPARTMENT OF ELECTRICITY, CITY OF CHICAGO

IMPORTANT NOTICE.

A permit must be obtained for **all** installations or alterations of electrical equipment.

A permit must be obtained **before the work is started.**

Permits will be issued to electrical contractors only when they are registered in conformity with the ordinances of the City of Chicago.

Application for permit must give the location by street and number. Locations on corners will not be accepted. The street number **must be correct.** A person doing work at any other location than that specified in the permit is in violation of the ordinance, and the records of the department are thereby confused and the furnishing of current delayed.

Application for permits to install wires or apparatus over or under public property, such as commercial street lighting posts, festoon lighting or temporary wires, must be made on a special form. The application must be approved by the Commissioner of Public Works and the Commissioner of Gas and Electricity before the permit will be issued. The authority of a franchise granted by the City Council is required for the installation and maintenance of wires over or under public property such as wires between buildings on opposite sides of a street or alley. An annual compensation fee is specified in the ordinances covering each franchise.

Application must be signed by the Supervising Electrician.

The inspection fee must be paid before a permit is issued. As this fee is based on the apparatus installed a **correct statement** of such apparatus must appear on the application.

The permit issued on an application will authorize only work therein applied for. If other work is done it must be covered by additional permits.

No current shall be used on apparatus installed under authority of a permit until the issuance of a temporary or final certificate.

When an installation is ready for current a request for current must be made on the form provided for this purpose. When forms are received covering both wiring and fixtures the temporary certificate will automatically issue. The request for current must, in all cases, be signed by some representative of the registered contractor.

Requests for current must not be sent in with the application for wiring. These requests must only be sent in after **the work is completed.**

A violation of the ordinances of the City of Chicago governing the installation and alteration of electrical equipment is punishable by a fine of from \$5.00 to \$50.00.

MICHAEL J. KENNEDY,

Commissioner of Gas and Electricity.

SPECIAL SUGGESTIONS TO ARCHITECTS.

Architects are urged to make definite specifications for electrical work, for the benefit of both the electrical contractor and the fixture contractor, specifying the number of outlets in each job for the electrical contractor to follow, and the exact number of 40 watt or equivalent.

It is also suggested that the architects demand of the electrical contractor that he make up all connections and combinations relative to switches, complicated outlets, etc., leaving only two wires for the fixture hangers to make his fixture connections.

GENERAL SUGGESTIONS.

In all electric work conductors, however well insulated, should always be treated as bare, to the end that under no conditions, existing or likely to exist, can a grounding or short circuit occur, and so that all leakage from conductor to conductor, or between conductor and ground, may be reduced to the minimum.

In all wiring special attention must be paid to the mechanical execution of the

work. Careful and neat running, connecting, soldering, taping of conductors and securing and attaching of fittings, are especially conducive to security and efficiency, and will be strongly insisted on.

In laying out an installation, except for constant current systems, every reasonable effort should be made to secure distribution centers located in easily accessible places, at which points the cutouts and switches controlling the several branch circuits can be grouped for convenience and safety of operation. The load should be divided as evenly as possible among the branches and all complicated and unnecessary wiring avoided.

CERTIFICATES.

When an electrical installation has been completed in accordance with the Standards and Specifications of the Chicago Electrical Code, and when the inspection fee has been paid, a certificate is issued by the Department of Gas and Electricity certifying to these facts. Architects should ask for the delivery of this certificate before making or authorizing final payment.

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Appleton Floodlight, (formerly National) are also made in several types and meet the requirements of a light of this kind.

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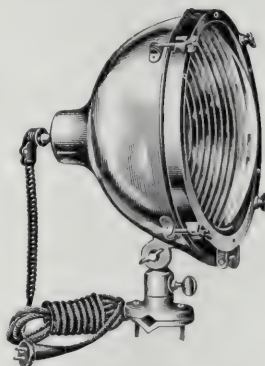
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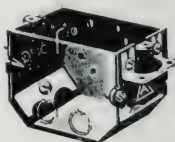
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ELECTRICAL ORDINANCE OF THE CITY OF CHICAGO COVERING ELECTRICAL INSTALLATIONS AND INSPECTIONS

Passed July 29, 1930.

Adopting the recommendations of the Electrical Commission of the city of Chicago.

Whereas, The Electrical Commission of the city of Chicago has formulated safe and practical standards and specifications for the installation, alteration and use of electrical equipment designed to meet the necessities and conditions that prevail in the city of Chicago; and has recommended their adoption by the City Council; and

Whereas, The said Commission has prescribed reasonable rules and regulations governing the issuance of permits by the electrical inspection bureau, and has recommended their adoption by the City Council; and

Whereas, The said Commission has also prescribed reasonable fees to be paid for the inspection by the electrical inspection bureau of all electrical equipment installed or altered within the city, and recommends their adoption by the City Council; therefore,

Be it ordained by the City Council of the city of Chicago:

Section 1. That the recommendation of the Electrical Commission of the city of Chicago of the standards and specifications for installation and repair of electrical equipment as contained in the amendment to Section 1632 of The Chicago Municipal Code of 1922, passed by the City Council of the city of Chicago on July 22, 1926, and appearing on pages 4327 and 4356 of the 1926 Journal of the Proceedings of the City Council, as safe and practical standards and specifications for the installation, alteration and use of electrical equipment within the city of Chicago, be and the same are hereby amended and adopted as the standards and specifications for the installation, alteration and use of electrical equipment in the city of Chicago.

Section 2. That the fees prescribed by the Electrical Commission of the city of Chicago to be paid for the inspection, by the electrical inspection bureau, of all electrical equipment installed or altered within the city of Chicago be and the same are hereby adopted as the fees for such inspection in the city of Chicago, said fees being as follows:

Wiring Only for Lighting Circuits—not including fixtures, sockets or receptacles. For the inspection of each complete branch lighting circuit of 1,000 watts or less; one dollar and fifty cents for one circuit, one dollar and twenty cents for each of the next four circuits, one dollar for each of the next five circuits, eighty-five cents for each of the next five circuits, seventy-five cents each for each of the next five circuits, sixty-five cents for each of the next five circuits and sixty cents for each succeeding circuit.

For the inspection of each complete branch lighting circuit of larger capacity than 1000 watts and not more than 2000 watts, the charge shall be double the fee of an equal number of 1000 watt circuits.

For the inspection of additional outlets on existing circuits; ten cents for each outlet on which a socket, receptacle or fixture will be attached.

Electrical Fixtures, Sockets and Receptacles—not including the circuit feeding same. For the inspection of fixtures, sockets or receptacles for lamps or nominal fifty watts capacity: one to fifteen lamps, fifty cents; sixteen to twenty lamps, seventy-five cents; twenty-one to twenty-five lamps, one dollar; twenty-six to thirty lamps, one dollar and twenty-five cents; thirty-one to forty lamps,

one dollar and fifty cents; forty-one to fifty lamps, one dollar and seventy-five cents; fifty-one to sixty lamps, two dollars; sixty-one to seventy lamps, two dollars and twenty-five cents; seventy-one to eighty lamps, two dollars and fifty cents; eighty-one to ninety lamps, two dollars and seventy-five cents; ninety-one to one hundred lamps, three dollars; one hundred and one to one hundred and ten lamps, three dollars and twenty cents; one hundred and eleven to one hundred and twenty lamps, three dollars and forty cents; one hundred and twenty-one to one hundred and thirty lamps, three dollars and sixty cents; one hundred and thirty-one to one hundred and forty lamps, three dollars and eighty cents; one hundred and forty-one to one hundred and fifty lamps, four dollars; one hundred and fifty-one to one hundred and sixty lamps, four dollars and twenty cents; one hundred and sixty-one to one hundred and seventy lamps, four dollars and forty cents; one hundred and seventy-one to one hundred and eighty lamps, four dollars and sixty cents; one hundred and eighty-one to one hundred and ninety lamps, four dollars and eighty cents; one hundred and ninety-one to two hundred lamps, five dollars; above two hundred lamps, five dollars for the first two hundred lamps and twenty-five cents for each group of twenty-five lamps or less. For lamps of capacity greater than fifty watts the charge shall be in proportion to the wattage of the lamp.

Wiring and Fixtures.—For the inspection of both circuit wiring and fixtures, sockets or receptacles: The aggregate sum of the fees as shown above for wiring and for electrical fixtures.

Motors and Other Forms of Power.—For the inspection of each electrical horsepower of seven hundred and forty-six watts used for mechanical or other purposes than above mentioned, one motor, \$2.00 plus 10c per horse power; additional motors 50c plus 10c per horse power. This fee to be applied to all motors over $\frac{1}{4}$ H. P.; motors of $\frac{1}{4}$ H. P. or under to be charged on an equivalent incandescent lamp basis.

Temporary Work, Outside Work, Etc.—Inspections of electric lights, other than electric signs as herein defined, placed on a public street or alley for the purpose of illuminating the same, temporary installations for show window exhibitions, conventions and the like, underground or overhead wires and apparatus, and all other inspections not specifically provided for herein, shall be charged for according to the time required for such inspections at the rate of two dollars per hour.

Reinspections.—Each reinspection of any overhead, underground or interior wires or apparatus, altered, changed or repaired and where a permit is required, shall be charged for according to the time required for such reinspection at the rate of two dollars per hour.

Extra Inspections.—Where extra inspections are made on account of any of the following reasons, a charge of one dollar and fifty cents shall be made for each such inspection; inaccurate or incorrect information, failure to make necessary repairs, faulty construction.

Minimum Fee.—No inspection shall be made for a less amount than one dollar and fifty cents.

Section 3. That the recommendation of the Electrical Commission of the city of Chicago

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OF BUILDING**



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BUSS-WA





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MFG. CO. 

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MFG. CO. 

of the rules and regulations governing the issuance of permits by the electrical inspection bureau be and the same are hereby adopted as reasonable rules and regulations for the issuance of permits by the electrical inspection bureau.

ARTICLE II.

Registration of Electrical Contractors.

1631. Electrical Contractor Defined.) The term "electrical contractor," as used in this article, shall be understood to mean any person, firm or corporation engaged in the business of installing or altering by contract electrical equipment for the utilization of electricity supplied for light, heat or power, not including radio apparatus or equipment for wireless reception of sounds and signals, and not including apparatus, conductors and other equipment installed for or by public utilities (including common carriers) which are under the jurisdiction of the Illinois Commerce Commission, for use in their operation as public utilities; but the term "electrical contractor" does not include employees employed by such contractor to do or supervise such work.

1632. Registration.) It shall be unlawful for any person, firm or corporation to engage in the business of electrical contractor, as herein defined, without being registered as an electrical contractor in the manner hereinafter set forth; Provided, however, that if such person, firm or corporation is already registered for the current year in another city or village within the State of Illinois such electrical contractor shall not be required to be registered or to pay a registration fee in this city.

1633. Application for Registration.) Any person, firm or corporation desiring to engage in the business of electrical contractor shall apply for registration to the commissioner of gas and electricity. Upon the filing of such application in proper form, and the payment of the registration fee fixed herein, the commissioner of gas and electricity shall register the applicant as an electrical contractor, and shall issue to the applicant a certificate of registration which will authorize the applicant to engage in such business for the year in which it is issued. The commissioner of gas and electricity shall keep a suitable record of such registrations.

1634. Fee for Registration—Term.) The fee for registration as an electrical contractor shall be twenty-five dollars (\$25.00) per annum, which sum shall be paid by the applicant to the City Collector in advance upon filing the application; provided, that when such application is made by an applicant, not previously registered, on or after July 1st of any year the fee for registration shall be \$12.50 for the remainder of such calendar year. The certificate of registration issued thereunder shall expire on the 31st day of December of the year in which it is issued.

1635. Penalty.) Any person, firm or corporation that shall engage in the business of electrical contractor without obtaining a certificate of registration as herein provided for, or that shall violate any of the provisions of this article, shall be fined not less than twenty dollars nor more than one hundred dollars for each offense, and a separate and distinct offense shall be regarded as committed every day on which such person, firm or corporation shall continue to operate contrary to the provisions of this article.

ARTICLE II-A.

Installation, Alteration, Use and Inspection of Electrical Equipment.

1636. Electrical Equipment Defined—Bureau Established.) The term "electrical equipment" as used herein is hereby defined as

meaning conductors and equipment installed for the utilization of electricity supplied for light, heat or power, but does not include radio apparatus or equipment for wireless reception of sounds and signals and does not include apparatus, conductors and other equipment installed for or by public utilities, including common carriers, which are under the jurisdiction of the Illinois Commerce Commission, for use in their operation as public utilities.

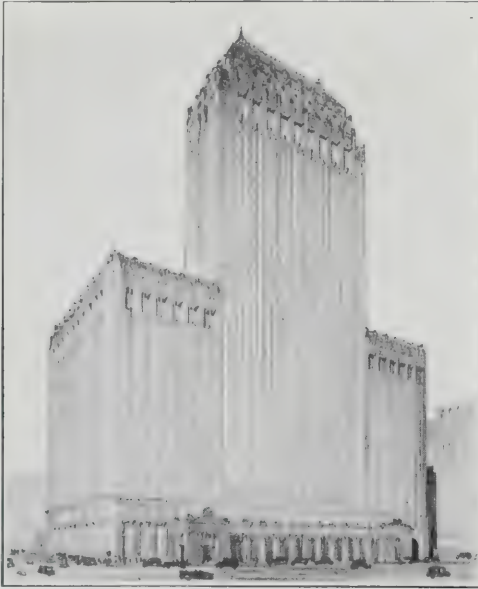
There is hereby established a bureau within the department of gas and electricity which shall be known as the electrical inspection bureau. Such bureau shall be the electrical inspection department of the city of Chicago authorized by the Act of the General Assembly of Illinois approved June 30, 1927, entitled "An Act in relation to the regulation of the installation, alteration and use of electrical equipment." Such bureau shall consist of the chief electrical inspector of the city and such other employees as may from time to time be provided for by the City Council. Such electrical inspection bureau shall be charged with the duty of enforcing the provisions of this ordinance, the rules and regulations of the department of gas and electricity and the standards and specifications for the installation, alteration and use of electrical equipment as herein defined and as prescribed by the electrical commission hereinafter provided for, and shall function under the immediate supervision and control of the commissioner of gas and electricity.

1637. Electrical Commission Created—Duties.) There is hereby established a commission to be known as the Electrical Commission of the city of Chicago, which shall consist of five members. The commissioner of gas and electricity shall be a member, and ex-officio chairman, of such commission. Of the other four members, one shall be an electrical contractor, one a journeyman electrician, one a representative of an inspection bureau maintained by the fire underwriters, and one a representative of an electricity supply company, who shall be appointed by the Mayor by and with the advice and consent of the City Council. The commissioner of gas and electricity shall serve on such commission without additional compensation therefor. The other members shall receive such compensation as may be fixed by the City Council.

It shall be the duty of the said commission to formulate and recommend safe and practical standards and specifications for the installation, alteration and use of electrical equipment designed to meet the necessities and conditions that prevail in the city, to recommend reasonable rules and regulations governing the issuance of permits by the electrical inspection bureau, and to recommend reasonable fees to be paid for the inspection by the electrical inspection bureau of all electrical equipment installed or altered within the city. The standards and specifications, rules and regulations and the fees so recommended shall become effective upon the passage of an ordinance adopting same by the City Council. All such fees shall be paid to the City Collector.

1638. Permits—Applications—Certificates—Reinspections.) No electrical equipment shall be installed or altered except upon a permit first issued by the electrical inspection bureau. The electrical inspection bureau shall issue permits for such installation and alteration of electrical equipment in all cases where application for such permit shall be made in accordance with the rules and regulations applicable thereto; provided, however, that no permit shall be issued for installing or altering the person, firm or corporation applying for such permit is registered as an electrical contractor as required by the ordinances of the city of Chicago. The electrical inspection bureau

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shall inspect all electrical equipment installed or altered, and shall require that it conform to the standards and specifications applicable thereto and adopted as aforesaid, and upon completion of such installation or alteration in compliance with such standards and specifications, shall immediately issue a certificate of inspection covering such installation or alteration.

The electrical inspection bureau is hereby empowered to reinspect any electrical equipment, and when said equipment is found to be unsafe to life or property shall notify the person, firm or corporation owning, using or operating same to place the same in a safe and secure condition in compliance with the standards and specifications described herein within such time as the electrical inspection bureau shall consider just and reasonable. Upon refusal or willful failure to comply with the requirements of such notification, in addition to the penalties otherwise provided herein, the electrical inspection bureau may order and compel the cutting off and stopping of such current until such electrical equipment has been placed in a safe and secure condition and in compliance with the standards and specifications referred to herein. No inspection fee shall be charged for such reinspection, but in case it becomes necessary to replace such electrical equipment on account of defects disclosed by such reinspection a permit therefor shall be obtained and an inspection fee paid as provided for in Section 1637.

The electrical inspection bureau shall keep complete records of all permits issued and inspections made and other official work performed under the provisions of this ordinance.

1639. Power to Enter Buildings—Make Inspections—Call Upon the Police Department—Suspension of Permit Privileges.) The commissioner of gas and electricity, the chief electrical inspector and his assistants shall have the power to enter buildings or premises at any reasonable hour in the discharge of their duties, and it shall be competent for them, when necessary, to remove any existing obstructions such as laths, plastering, boarding or partitions which may prevent a perfect inspection of the electrical equipment, and it shall be unlawful for any person to interfere with them in the performance of their duties. Whenever, in the opinion of the commissioner of gas and electricity, it shall be necessary to call upon the department of police for aid and assistance in carrying out or enforcing any of the provisions of the ordinances of the city of Chicago governing the inspection of electrical equipment, he shall have the authority to do so, and it shall be the duty of any member of the department of police, when called upon by said commissioner of gas and electricity, to act according to the instructions of and to perform such duties as may be required by such commissioner of gas and electricity in order to enforce or put into effect the provisions of the ordinances of the city of Chicago relating to the inspection of electrical equipment.

Suspension of Permit Privileges. The commissioner or the chief inspector of the department of gas and electricity, is hereby empowered to suspend for a period of one year, the permit privileges of persons, firms or corporations, for the installation of electrical wiring, apparatus and equipment, whose work, after inspection of a reasonable number of installations by the bureau of electrical inspection, shows a lack of sufficient knowledge of the code rules and regulations of the department of gas and electricity of the city of Chicago; also to suspend for a period of one year the permit privileges for the installation of electrical wires, apparatus and equipment, of persons, firms or corporations, who fail to comply, within such a period of time as said commissioner or chief inspector shall consider

just and reasonable, with written notices requiring their installations to be in conformity with the code rules and regulations of the department of gas and electricity of the city of Chicago.

The commissioner or the chief inspector of the department of gas and electricity, is hereby empowered to suspend the permit privileges of persons, firms or corporations, who fail to pay any just indebtedness to the city of Chicago for inspection fees of electrical wiring and apparatus as fixed by this ordinance, until such person, firm or corporation shall discharge and pay to the city of Chicago, all just indebtedness then due and owing from such person, firm or corporation.

1640. Use of Equipment.) Whenever any electrical equipment has been installed or altered, no electrical current shall be supplied to or used on such equipment previous to the inspection of such equipment by the electrical inspection bureau and the issuance of a certificate of inspection covering such installation or alteration; provided, that the inspection bureau may issue a temporary certificate for the use of electrical current during the course of construction or alteration of buildings which temporary certificate shall expire when the construction or alteration of such building is complete.

1641-A. Penalties.) Any person, firm or corporation that shall install or alter any electrical equipment after the approval of the standards and specifications and the fees prescribed therefor, except such as is exempt from the provisions of this ordinance, without first having secured a permit as provided for herein, or any person, firm or corporation that shall violate or willfully fail or refuse to comply with the provisions of this ordinance or with the rules, standards or specifications established by the Electrical Commission of the city of Chicago that have been adopted by the City Council, shall, upon conviction thereof, be fined not less than five dollars (\$5.00) nor more than fifty dollars (\$50.00) for each offense.

(b) Penalty for Breaking Seals.) The chief electrical inspector of the department of gas and electricity, or his respective assistants, are hereby empowered to attach to electrical cabinets and equipment, any notice or seal, and it shall be unlawful for any person to break, change, destroy, tear, mutilate, cover or otherwise deface or injure any notice or seal posted by the department of gas and electricity; any person violating any of the provisions of this section shall be fined not less than twenty-five dollars (\$25.00) nor more than one hundred dollars (\$100.00) for each offense.

(c) Impersonating an Electrical Inspector.) No person, who is not a lawful city electrical inspector, shall impersonate an electrical inspector, or officer of the electrical department under penalty of not less than twenty-five dollars (\$25.00) nor more than one hundred dollars (\$100.00).

ARTICLE III

Illuminated Signs

1642. Projecting Signs, Etc., Prohibited—Except Illuminated Signs.) No person, firm or corporation shall place on or suspend from any building, structure, lot or place any goods, wares, or merchandise whatever, or signs other than illuminated signs as hereinafter provided, or any other thing, so that the same shall project from the wall or front of such building, structure, lot or place, into the street or over the sidewalk. Whoever shall violate any of the provisions of this section shall be fined not less than five dollars (\$5.00) nor more than fifty dollars (\$50.00) for each offense.

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1643. General Requirements — Definition.) It shall be unlawful for any person, firm or corporation to erect or cause to be erected or maintain any illuminated sign over any sidewalk, street, avenue, alley or public way in the city except in accordance with the ordinance of the city of Chicago.

For the purpose of this article, illuminated signs shall be deemed to be signs constructed as follows: signs, all or any part of the letters or characters of which are made in an outline of electric lamps; signs with painted, flush or raised letters, or characters lighted by an electric lamp or lamps attached thereto; signs having a border of electric lamps attached thereto and reflecting light thereon; transparent glass signs whether lighted by electricity or other illuminant; signs with painted, flush or raised letters or characters illuminated by electric lamps or lamps placed for the purpose of projecting or reflecting light thereon; and signs having any electrical equipment attached thereto.

1644. Compensation — Illuminated Signs.) The owner or person having charge of any illuminated sign authorized by this article which projects in whole or in part over any sidewalk, street, avenue, alley or public way in the city shall pay for the use of the city, as compensation for the maintenance of same in such place, and to cover the expense of inspection, an annual fee to be computed according to the following classification and schedule:

Projecting Signs.

The fee for all signs projecting at right angles or obliquely from the building or structure against which same are placed, whether such signs are vertical or horizontal, and not being flat signs are hereinafter described, shall be computed at the rate of fifteen cents per annum per square foot of sign surface on each illuminated side of such signs, provided, however, that no fee shall be less than two dollars and fifty cents.

Flat Signs

The fee for all signs placed against a building or structure running parallel thereto and not projecting obliquely or at right angles therefrom containing twenty-five nominal fifty watts, or fifty volt-ampere lamps or less shall be two dollars and fifty cents, to which shall be added nine cents for each of the next twenty-five lamps, seven cents for each of the next twenty-five lamps, six cents for each of the next one hundred lamps, five cents for each of the following one hundred lamps, and four cents for each additional lamp above three hundred. Fees if lamps are of other than fifty watts or fifty volt-ampere rating shall be based on the total connected load reduced to fifty volt-ampere units and the above schedule applied.

Temporary Signs.

The fee for illuminated signs installed for temporary use for special occasions, not to exceed thirty days, shall be computed at one-fourth of the annual rate fixed for the particular type or style of sign, whether projecting or flat.

1645. Application—Permit—Certificate—Inspection—Renewal.) No illuminated sign shall be erected, altered or maintained over any sidewalk, street, alley or public way in the city except upon a permit first issued by the electrical inspection bureau. The electrical inspection bureau shall issue permits for such erection, alteration or maintenance of illuminated signs in all cases where application for such permit shall be made in accordance with the rules and regulations applicable thereto; provided, however, that no permit shall be issued for the erection, alteration or maintenance by contract unless the person, firm or

corporation applying for such permit is registered as an electrical contractor as required by the ordinances of the city of Chicago. Application shall be made to the electrical inspection bureau for that purpose on printed form to be furnished therefor by the electrical inspection bureau. When such application is in accordance with the rules and regulations applicable thereto, the electrical inspection bureau shall issue to such applicant, upon the payment by such applicant to the city collector of the compensation as heretofore fixed, a permit in writing, authorizing such applicant to erect the sign at the location designated in such application and of the style or design described therein. Upon the completion of the work of erecting such sign under such permit the applicant shall forthwith notify the electrical inspection bureau. The electrical inspection bureau shall inspect said sign with respect to safety, construction, supporting equipment and electrical equipment; and when the electrical inspection bureau shall find that such sign has been constructed, erected and connected electrically in accordance with the ordinances of the city of Chicago, it shall thereupon issue to such applicant a certificate in writing authorizing the operation and maintenance of said sign for the period of one year from the date of the filing of application therefor; such certificate to be issued without further cost or expense other than the fees hereinbefore provided. The use of electrical current, or other illuminant, in connection with such sign, previous to the issuance of the certificate last described, is prohibited, except by order of the electrical inspection bureau, for the purpose of testing the same to see whether it is connected electrically in accordance with and pursuant to the provisions of the ordinances of the city of Chicago.

A renewal certificate must be obtained annually by the person, firm, or corporation having charge or control of said sign as provided for in Section 1644 and Section 1647.

No attachment or addition thereto shall be made to any sign erected or maintained under the authority of this article unless all the provisions herein are fully complied with and unless a permit be first issued for the express purpose of allowing such attachment or addition by the electrical inspection bureau. The fee shall be as provided for in Section 1644 for such attachment or addition, provided however no fee shall be less than two dollars and fifty cents.

No sign erected or maintained under the authority of this article which has been removed temporarily for repairs or alteration shall be rehung unless a permit be first issued for the express purpose by the electrical inspection bureau. The fee for this permit shall be not less than two dollars and fifty cents.

1646. Location—Time of Illumination.) The supporting structure for any sign erected under and pursuant to the provisions of this article, shall be wholly inside of the property line. The lowest part of the sign shall be at least nine feet above the surface of that part of the public way which any such sign overhangs, and the part of any such sign nearest to the building or structure to which it is attached shall be not more than two feet from building line. No sign erected under the authority of this article shall be permitted to project beyond the curb line.

All sides of every such sign which are designed to be illuminated shall be illuminated each and every night for a period of time not less than from dusk until the hour of 9:30 p. m.

The authority granted for the erection and maintenance of any such sign may be revoked at any time by order of the Mayor or of the City Council, and any compensation or permit fees paid to the city for such sign shall not be refunded in case of any such revocation.

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1647. **Compliance with Ordinances.)** Every sign erected and maintained, under and pursuant to the provisions of this article shall comply with the provisions of this article and with all other ordinances of the city relating to the erection, maintenance and installation of such sign and the installation and use of electrical equipment, and shall be installed and maintained in all other respects in a safe and secure manner.

The electrical inspection bureau shall make an annual inspection of each sign erected under provisions of this article with regard to its mechanical and electrical safety, and when such sign is found to comply with the provisions of this article shall, upon receipt of compensation hereinbefore provided, issue a renewal certificate to operate and maintain said sign for one year from the date of expiration of the previous certificate.

It shall be the duty of the electrical inspection bureau to remove or cause the removal of any sign not in compliance with the provisions of this article.

1648. **Penalty.)** Any person, firm or corporation that shall erect or cause to be erected or maintain an illuminated sign or an attachment or addition thereto or use any electric current or other illuminant in any sign in violation of any of the provisions of this article, shall be fined not less than five dollars (\$5.00) nor more than fifty dollars (\$50.00) for each offense, and shall be fined a further sum of five dollars (\$5.00) for each and every day on which he, they or it shall permit or cause any such sign to be maintained or any electric current or other illuminant to be used therein in violation of any of the provisions of this article; and in addition to such penalties the electrical inspection bureau shall, for violation of any of the provisions of this article, compel the cutting off and stopping of electric current or other illuminant supplied to any such sign, and if deemed necessary or advisable shall remove or cause such sign to be removed.

ILLUMINATED SIGNS OUTSIDE OF BUILDINGS AND NOT PROJECTING OVER PUBLIC PROPERTY

1648-A.) No person, firm or corporation shall erect or cause to be erected or maintain any illuminated sign, which is attached to the front, sides, or rear wall of any building or to any structure, and which does not extend over any sidewalk, street, alley, or public way; or shall install or alter or cause to be installed or altered any electrical equipment for the purpose of illuminating any billboard, sign board, or roof sign erected under the provisions of Article 23, Sections 903 to 916 inclusive, and Section 919 of the Chicago Municipal Code of 1922; except upon a permit first issued by the electrical inspection bureau. The electrical inspection bureau shall issue permits for the installation, or alteration, of the electrical equipment of such signs in each case where application for such permit shall be made in accordance with the rules and regulations applicable thereto; provided, however, that no permit shall be issued for the erection or alteration by contract, unless the person, firm or corporation applying for such permit is registered as an electrical contractor as required by the ordinance of the city of Chicago.

1648-B.) For the purpose of this article, illuminated signs shall be deemed to be signs constructed as follows: signs, all or any part of the letters or characters of which are made in an outline of electric lamps; signs with painted, flush or raised letters, or characters lighted by an electric lamp or lamps attached thereto; signs having a border of electric lamps attached thereto and reflecting light thereon; transparent glass signs whether lighted by electricity or other illuminant;

signs with painted, flush or raised letters or characters illuminated by electric lamp or lamps placed for the purpose of projecting or reflecting light thereon; and signs having any electrical equipment attached thereto.

1648-C.) The electrical inspection bureau shall inspect all such illuminated signs, and electrical equipment installed or altered for the purpose of illuminating billboards, sign boards, and roof signs, and shall require conformity with the standards and specifications of the Chicago Electrical Code applicable thereto, and upon completion of such installation or alteration in compliance with such standards and specifications, shall issue a certificate of inspection covering each installation or alteration.

It shall be the duty of the electrical inspection bureau to make an inspection annually of all such signs and electrical equipment of all billboards, signboards, and roof signs, and whenever said electrical inspection bureau shall find that any electrical equipment on any illuminated sign, billboard, signboard, or roof sign has been installed or altered in violation of this article, and the Chicago Electrical Code, or is in an unsafe condition, it shall notify the person, firm or corporation owning, using, or operating the same, to place the same in a safe and secure condition, and in compliance with the standards and specifications applicable thereto, within such time as the electrical inspection bureau shall consider just and reasonable. Upon refusal, neglect, or failure to comply with the requirements of such notification, the electrical inspection bureau may order, and compel, the cutting off and stopping of electrical current on such installation until electrical equipment has been placed in a safe and secure condition, and in compliance with the standards and specifications of the Chicago Electrical Code.

The person, firm or corporation having charge, or control, of any illuminated sign, billboard, signboard, or roof sign maintained under the provisions of this article, shall in addition to the Building Department fee as provided in Sections 914 and 919, pay an annual fee for such inspection, to be computed according to the following schedule:—

1648-D.) The fee for illuminated signs, billboards, signboards, and roof signs illuminated by twenty-five nominal fifty-watt, or fifty volt-ampere lamp, or less, shall be two dollars and fifty cents, to which shall be added nine cents for each of the next twenty-five lamps, seven cents for each of the next twenty-five lamps, six cents for each of the next one hundred lamps, five cents for each of the following one hundred lamps, and four cents for each additional lamp above three hundred. Fees, if lamps are of other than fifty watts, or fifty volt-ampere rating, shall be based on the total connected load reduced to fifty volt-ampere units and the above schedule applied.

1648-E.) Any person, firm or corporation that shall erect or cause to be erected, or maintain an illuminated sign, or install, alter or cause to be installed or altered, or maintain any electrical equipment for the purpose of illuminating any billboard, signboard, or roof sign in violation of any of the provisions of this article, shall be fined not less than five dollars (\$5.00), nor more than fifty dollars for each offense, and shall be fined a further sum of five dollars (\$5.00) for each and every day he, they, or it shall permit or cause any such sign to be maintained, or any electrical current, or other illuminant to be used thereon in violation of any of the provisions of this article, and in addition to such penalties the electrical inspection bureau shall, for violation of any of the provisions of this article, and the Chicago Electrical Code, compel the cutting off and stopping of electrical current, or other illuminant supplied to any such sign.

Beardslee Creates Chandeliers—Lanterns—Brackets



WHEN in your plans for new construction or remodeling, you come to think of Lighting fixtures, you naturally want the experience and knowledge of Lighting problems: the ability to suggest, to recommend, to interpret your ideas: the skill to create, design and manufacture, artistic, distinctive Lighting Fixtures: active, intelligent co-operation—you will find that here.

WITH full confidence, assurance of complete satisfaction and the job on time, put up to us any Lighting problem—Residence, Hotel, Store, Church, Bank, Apartments, Theatre, Public Building, Hospital, School—any style—Modernistic, Spanish, Colonial, Elizabethan, Gothic, &c. &c., you have and find pleasure and pride in the result.

OUTLINE your needs in a letter, rough sketch or blue prints. The more complete, the more speedy our dispatch to you of suggestions, recommendations for harmonizing, decorative Lighting Fixtures, sound in design and construction.



BEARDSLEE CHANDELIER DIVISION
Beardslee Chandelier Mfg. Co.
216 South Jefferson St., Chicago
Phone Monroe 6530

ARTICLE V

Lamp Posts—Festoons—Decorative Street Lighting Equipment

1659. No person, firm or corporation shall install or cause to be installed, construct, maintain or use any electric lamp post, festoon or decorative street lighting equipment upon any sidewalk, street, avenue, alley or public way within the city of Chicago except as hereinafter provided.

For the purpose of this ordinance, electric lamp posts shall be deemed to be lamps supported on posts and constructed in accordance with Section 1462 of this Article. Festoons and decorative lighting equipment shall be deemed to be lamps attached to wires or structures which extend over any public property and shall not apply to lamps attached to the aforesaid posts, or to any sign, canopy or structure now authorized by any existing ordinance of the city of Chicago.

This ordinance shall not be construed as applying in any way to street lighting posts or equipment erected, owned or maintained by the city of Chicago.

1660. Application for permits—permits.) Any person, firm or corporation desiring to install, alter or repair any electric lamp post, festoon or decorative street lighting equipment on or over any public way in the city of Chicago, shall make an application to the commissioner of public works for that purpose, on a form furnished therefor by the department of gas and electricity setting forth therein such information as is required by such department. Such application when made shall be submitted by the commissioner of public works to the commissioner of gas and electricity for his approval and when the same shall be approved by both the commissioner of public works and the commissioner of gas and electricity, a permit in writing authorizing such applicant to install, alter, repair and maintain electric lamp posts, festoons or decorative lighting equipment at the location or locations designated in such application, shall thereupon be issued by the commissioner of public works and no work of any kind shall be started until such permit has been obtained.

No permit shall be issued under the authority of this ordinance for the installation of any street post other than such as conform to the standards and specifications prescribed in Section 1662 of this ordinance.

Permits for the maintenance of electric lamp posts, festoons or decorative street lighting equipment shall authorize such maintenance for any period of time not to exceed ten (10) years from the date of the issuance of said permit and it shall be expressly understood that such permit shall be revocable by the Mayor of the city of Chicago at any time for any violation of any section of this ordinance or for the interference with the proper installation or operation of any equipment for any purpose whatsoever that the city of Chicago has or may install or maintain on or over any public way.

1661. Bond required.) No permit shall be issued to install, alter, repair or maintain any electric lamp post, festoon or decorative lighting equipment until the person, firm or corporation making an application for such permit shall have filed with the City Collector of the city of Chicago, an indemnifying bond with good and sufficient sureties equal to the sum of one hundred dollars (\$100.00) for each electric lamp post, festoon or branch circuit for decorative lighting equipment installed or maintained. The aforesaid bonds shall guarantee the installation and maintenance of any and all electric lamp posts, festoons or decorative lighting equipment specified in the application for a permit in accordance with the provisions of this ordinance and the standards and specifications of the Chicago

Electrical Code of the city of Chicago applicable thereto, or to remove from the public way in a manner satisfactory to the commissioner of public works and the commissioner of gas and electricity, upon notice from the commissioner of gas and electricity, within thirty days after the expiration date of the permit to maintain such electric lamp post, festoon or decorative lighting equipment. The aforesaid bonds shall further guarantee the removal from the public way in a manner satisfactory to the commissioner of public works and the commissioner of gas and electricity, any and all electric lamp posts, festoons or decorative lighting equipment specified in any permit revoked by the Mayor of the city of Chicago within a period of thirty days after having received notice thereof.

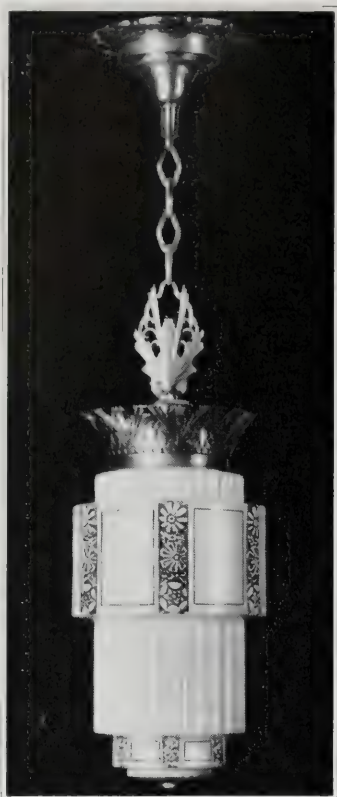
The aforesaid bonds shall guarantee only compliance with the provisions of this ordinance and shall not be construed as replacing or abrogating any other bond which may be required by any other ordinance of the city of Chicago; shall not be construed as in any way affecting the liability of any person, firm or corporation, installing, repairing, altering or maintaining on the public way any electric lamp post, festoon or decorative lighting equipment, for the payment of damages which may result from such installation, repair, altering or maintenance.

In the event of the failure of any person, firm or corporation to comply with any provision of this ordinance, the commissioner of gas and electricity shall notify the guarantors and should any violation continue for a period of more than thirty days, he shall declare the bond applying to the electric lamp post, festoon or decorative lighting equipment, in violation forfeited and the city collector of the city of Chicago is herein authorized to collect the full amount of such bond.

1661-A). The commissioner of gas and electricity is herein authorized to remove or cause to be removed any electric lamp post, festoon or decorative lighting equipment, installed under the authority of this ordinance, from the public way for violation of any of the provisions of this ordinance; or to remove from the public way any electric lamp post, festoon or decorative lighting equipment installed previous to the passage of this ordinance for violation of any of the provisions of Section 1663 of this ordinance; provided, however, that no electric lamp post, festoon or decorative lighting equipment shall be removed by the commissioner of gas and electricity until thirty (30) days after due notice to the guarantors in all cases where the electric lamp post, festoon or decorative lighting equipment was installed under the authority of this ordinance and to the property owner nearest such lamp post, festoon or decorative lighting equipment when the same was installed before the passage of this ordinance.

1661-B. Fees.) All electric lamp posts, festoons or decorative lighting equipment installed on public property, shall be inspected by the bureau of electrical inspection after installation, and thereafter annually, and shall require the same to comply with the provisions of this ordinance and the standards and specifications of the Chicago Electrical Code of the city of Chicago. The fee for the original inspection of each electric lamp post, festoon or decorative lighting equipment circuit of two thousand (2000) watts or less capacity shall be two dollars (\$2.00). The annual fee for the aforesaid inspection shall be one dollar and fifty cents (\$1.50) for each electric lamp post, festoon or decorative lighting equipment circuit inspected. Provided, however, that no annual fee shall be charged for electric lamp posts unless the same shall be found to be in violation of this ordinance.

1162. Type—specifications.) Any electric lamp post for commercial street lighting



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1st—You choose the very best quality in illuminating glassware.

2nd—You choose the very best in the combination of beauty and utility.

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20 No. Wacker Drive Bldg., Chicago, Ill.

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Inland

QUALITY GLASS

erected upon any sidewalk, street, avenue, alley or other public way within the city shall conform in design and construction to the specifications hereinafter stated.

COMMERCIAL STREET LIGHTING

Concrete posts. Shall be constructed of artificial granite concrete, natural gray in color and shall conform in design and dimensions to drawing No. 7919 dated March 1st, 1929, which is attached to and which is hereby made a part of this ordinance.

Concrete posts shall be constructed of a proper mixture of clean crushed granite, quartz or other suitable stone passing through screen of not more than one-half inch mesh, fresh Portland cement and clean water free from acids, alkalies or organic matter.

Each post shall be of solid reinforced concrete, very dense in character and free from air pockets or other voids. A duct of not less than two (2) inches in diameter shall extend throughout the length of the post. This duct may consist either of a standard iron pipe or a tubular passage through the body of the concrete. The duct shall be free from sharp projections or edges of a character which might injure the lead sheath of cables or the insulation of wire.

The iron pipe referred to above and all reinforcement material must be so imbedded that its outline will not appear through the surface of the post and the post shall not, either when new or after continued use, show rust spots on the surface due to the use of such pipes or reinforcing material.

Each concrete post shall have a malleable iron spider of the design and dimensions shown on drawing No. 7919, dated March 1st, 1929, imbedded in the concrete in such a manner as to be integral with same. The spider shall be securely connected to the reinforcing rods and the iron pipe. No part of the spider shall extend below the concrete.

All posts shall have a weight, exclusive of globes, globe holders and electrical equipment, of not less than four hundred (400) pounds and shall be sufficiently strong to withstand without any injury whatever or permanent deformation a stress of such force as is specified in the following table; such stress being applied at the extreme top of the shaft in any direction at right angles to the axis of the post, the post being supported only by its base which shall be attached firmly to a stable foundation or anchored to the testing apparatus.

The ultimate strength at which any post shall actually fail to withstand any additional stress without permanent injury or deformation shall be not less than twice the test load in pounds specified in the following table:

Table.

Test Load	Ultimate Load
in Lbs.	in Lbs.
375	750

All posts shall meet the above requirements as to strength and weight at any time subsequent to thirty days after such products are first cast.

The post shall be properly cured and shall be smooth and workmanlike in finish. The outer film of cement formed on the post during manufacture must be removed by suitable treatment to leave the surface of the post in a natural, brilliant, crystalline finish of essentially uniform appearance. The finished post shall show no distortion, mechanical defects, surface cracks, cement streaks nor cement patches and shall not be injuriously affected by sudden changes or extreme outdoor weather conditions.

Each post shall be provided with a globe holder which shall be firmly and rigidly attached to the post in such a manner that no undue strain will be placed upon the concrete through wind pressure or other stresses. The globe holder shall be of non-rusting material or of cast iron. Where cast iron is used the casting shall, after its manufacture, be hot galvanized both inside and outside. Before installation the entire casting shall be given a coat of weatherproof paint.

In all other respects concrete posts shall conform in design and construction to drawing No. 7919 which is on file in the office of the Commissioner of Gas and Electricity.

Metal Posts.—Shall be constructed of good cast iron or sheet metal, clean cut, smooth and workmanlike in finish or of sheet steel, and shall conform in design and dimensions to drawing No. 7625 which is hereby made a part of this ordinance and which is on file in the office of the Commissioner of Gas and Electricity.

All castings shall be of the best quality, free from flaws, blow holes, cracks, burs, imperfect edges or other imperfections.

Posts shall have a weight, exclusive of globes, globe holders and electrical equipment, of not less than three hundred and fifty (350) pounds for cast iron posts and two hundred and fifty (250) pounds for sheet metal posts and shall be sufficiently strong to withstand without any injury whatever or permanent deformation a stress of such force as is specified in the following table: such stress to be applied at the extreme top of the shaft in any direction at right angles to the axis of the post, the post being supported by its base which shall be attached to a stable foundation or anchored to the testing apparatus.

The ultimate strength at which any post shall actually fail to withstand any additional stress without permanent injury or deformation shall be not less than twice the test load in pounds specified in the following table:

Table.

Test Load	Ultimate Load
in Lbs.	in Lbs.
375	750

All posts shall, after manufacture, be treated on the outside with not less than one coat of red lead and oil. After erection each post shall be painted with not less than one coat of weatherproof paint.

General.—Each post shall be equipped with one lamp of not less than 300 watts nor more than 1000 watts and shall be provided with an approved white diffusing globe and canopy of glass having minimum color distortion and of such density as to conceal the outline of the filament of the lamp. The globe and canopy shall be substantially of the design and dimensions shown in drawings Nos. 7625 and 7919, under date of March 1st, 1929, hereinbefore referred to.

1663. Illumination—maintenance of posts—signs on posts.) All electric lamp posts, festoons or decorative lighting equipment erected under authority of this ordinance shall be illuminated each and every evening from dusk until 9:30 P. M. All burned out lamps and all broken or cracked globes shall be immediately replaced. Iron posts and iron parts of other posts shall be kept painted so that the original color will be retained and rust spots will not show. Posts which through accident have become cracked, chipped or damaged must be replaced in a condition satisfactory to the Bureau of Electrical Inspection. The posts and lamps must be maintained in a good and safe condition and in strict conformity with all the requirements of this ordinance. Any post which, through the settling of its foundation or as the result of an

• • making the home kitchen modern

The day is at hand when many home economics authorities and homemakers agree that no kitchen can be considered a strictly modern kitchen unless it has an electric dishwasher. "The most advanced electrical dishwasher on the market," is the way architects who have had an opportunity to make careful comparisons refer to the

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It washes » rinses » dries

Architects who specify the CONOVER Electric Dishwasher Sink in new homes and apartments, or when modernizing old ones, are going to increase very substantially the resale and renting values of the buildings thus equipped.

Many advanced features, including rubber-plated dishracks; large flexible capacity; sliding drainboard top; self cleansing. Various sizes and models to meet practically every requirement, including models for tiling-in and for cabinet installation. All models available with drainboards on right or left, and in regular or acid-resisting enamel, in white, green and other popular colors.

Highly Approved!

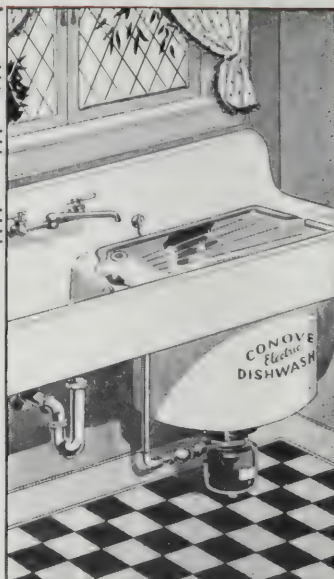
The Conover Electric Dishwasher is made by specialists who, for years, have concentrated entirely on the development, manufacture, sale and service of dishwashers for home use. It is endorsed by Good Housekeeping Institute, Delineator Home Institute, architects, master plumbers and highly satisfied users.

The CONOVER Sink Models are sold exclusively through Master Plumbers, supplied by leading plumbing supply wholesalers.

The CONOVER portable Model line is sold only through the Electrical Trade.

As an architect you will be interested in information on sink models.

Write for catalog—"Making the Home Kitchen Modern"



Takes drain at ordinary height—therefore ideal for replacing old sinks and simplifying new installations.

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Homemakers, home owners, architects, contractors, builders, plumbers—all who are interested in making homes convenient and attractive are learning the many advantages of the CONOVER Electric Dishwasher through CONOVER advertising in the following publications:

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The New Yorker
Small Home Magazine
Architectural Record
Architectural Forum
National Real Estate Journal
Plumbers and Heating Contractors Trade Journal
Domestic Engineering
Electrical Merchandising
Leading metropolitan newspapers in Chicago, Boston, Philadelphia, etc.

THE CONOVER COMPANY

General Offices and Chicago District Display Room:

140 So. Dearborn Street, Chicago

accident has been displaced, shall be restored to its original upright position. No numbering, lettering, reflectors, signs or objects of any description shall be attached to or placed upon the posts or glassware and only clear white or frosted incandescent lamps shall be used.

1664. Penalty.) Any person, firm or corporation violating any of the provisions of this ordinance or failing to comply with the same shall be fined not less than five dollars (\$5.00) nor more than fifty dollars (\$50.00) for each offense and a separate offense shall be regarded as committed each day on which such person, firm or corporation shall maintain, contrary to this ordinance, any lighting post erected after the ordinance becomes effective.

ARTICLE VII

Non-Professional Motion Picture Projectors and Equipment.

1669. Definitions.) The following definitions shall apply for the purposes of this article:

Non-Professional Motion Picture Projector: A motion picture projector intended for use with slow-burning (acetate cellulose or equivalent) film only.

Miniature Non-Professional Motion Picture Projector: A non-professional motion picture projector whose construction provides for the use of films of a width less than one and three-eighths (1 $\frac{3}{8}$) inches which film is regularly supplied only as slow-burning (acetate cellulose or equivalent) film.

Slow-Burning Film: Motion picture projection film printed on film stock of cellulose acetate composition or on other stock approved as slow-burning.

Approved: Acceptable to the commissioner of gas and electricity of the city of Chicago.

1670. Identification of non-professional motion picture projectors.) Such projectors shall be marked with the name or trade mark of the maker, and with the voltage and current rating for which they are designed, and shall also be plainly marked, "For use with slow-burning films only."

Identification of Slow-Burning Film: Slow-burning (cellulose acetate or equivalent) film shall have a permanent distinctive marker for its entire length identifying the manufacturer and the slow-burning character of the film stock.

1671. Approval required.) Non-professional motion picture projectors and equipments including all auxiliary mechanical and electrical projection appliances intended for installation and use within the jurisdiction of the commissioner of gas and electricity of the city of Chicago shall be established as approved.

Approved non-professional motion picture projectors and equipment appliances shall be installed.

1672-A. Illuminant.) The source of illumination of the projected view shall be an incandescent lamp.

1672-B. Connection to supply power.) The wiring, and the means and manner of connection thereto for any non-professional motion picture projector shall be as provided in subsections 1 to 19 inclusive of this code.

1673. Highly inflammable film prohibited.) No highly inflammable film other than approved slow-burning (acetate cellulose or equivalent) film shall be used with any non-professional motion picture projector.

1674. Fireproof booth unnecessary.) The location of a non-professional motion picture projector in a fireproof booth shall not be required.

1675. Location in assembly halls and rooms.) The installation and operation of non-professional motion picture projectors located in assembly halls and assembly rooms shall be as provided in 1676 and 1677 of this code.

1676. Permit required.) A permit for each location, as provided in section 1638 of this code shall be first issued for the installation and use—whether permanent or temporary—of any non-professional motion picture projector, except a miniature non-professional motion picture projector and also except any projector installed in a location for projection elsewhere than in an assembly hall or an assembly room provided that these exceptions shall not apply where the means afforded for connection to supply power are not in accordance with section 1676. The permit as provided in section 1638 of this code shall be posted, at all times, in a conspicuous place on the premises appertaining where such non-professional motion picture projector is installed or in use.

1677. Licensed operator required.) When located for projection in assembly halls or assembly rooms, non-professional motion picture projectors, except miniature non-professional motion picture projectors, shall be operated by licensed operators as provided for in section 2776 of this code.

1678. Penalty.) Any person, firm or corporation using highly inflammable film or film other than approved slow-burning (acetate cellulose or equivalent) film with a non-professional motion picture projector or violating any provisions of this article or failing to comply with the same, shall be fined not less than ten dollars (\$10.00) nor more than two hundred dollars (\$200.00) for each and every offense, and each day's violation thereof shall be considered a separate and distinct offense.

CHAPTER LII

Moving Pictures.

ARTICLE I

Moving Picture Operators.

2776. Moving picture machine operators—license required—applications for license—examinations.) It shall be unlawful for any person to operate a moving picture machine or device for any public or private gathering without first having obtained a license as a moving picture operator in the manner hereinafter set forth; provided, that this article shall not apply to the operation of any moving picture machines or devices of a miniature type for home, lecture and similar purposes requiring 16 millimeter slow burning type film. Any person desiring to operate a moving picture machine or device shall make application for a license to the commissioner of gas and electricity, and shall, at such time and place as said commissioner of gas and electricity may designate, be compelled to pass such examination as to his qualifications as said commissioner of gas and electricity may direct. Said examination may be made in whole or in part in writing and shall be of a practical and elementary character, but sufficiently strict to test the qualifications of the applicant. Every applicant for a license as a moving picture operator shall be twenty-one (21) years of age or over, and shall have served as apprentice to a regularly licensed operator for a period of not less than one (1) year in conformity with Section 2778 of this code, or shall have heretofore served as a moving picture operator for a period of not less than one (1) year, proof of which service shall be furnished in a manner satisfactory to the commissioner of gas and electricity.

HENRY NEWGARD & COMPANY

Established 1882

Electrical Contractors



549 W. Washington Street

CHICAGO

Phones Franklin 7066-7-8

2777. Certificate of competency—license fee.) Every qualified applicant shall be duly examined by the commissioner of gas and electricity as to his practical knowledge of the operation and maintenance of moving picture machines and devices, and if found competent, shall receive a certificate from said commissioner of gas and electricity stating that he is competent to operate moving picture machines and devices. Such applicant shall then present said certificate to the city clerk, who shall issue a license properly attested to such applicant, which license shall be good for one (1) year; provided, that any person who has received a license hereunder as an operator of moving picture machines shall not be required to be again examined in order to renew the same. Each person who has qualified to take the examination for which provision is herein made shall, before taking such examination, pay to the city collector the sum of twenty-five dollars (\$25.00), which sum shall, in the event that such person passes the examination, entitle the applicant to such license upon proper certification by the commissioner of gas and electricity and shall constitute the first license fee for the applicant. After the first year provided for herein the annual license fee shall be ten dollars (\$10.00). In the event that said applicant fails to pass the examination he shall be entitled to take subsequent examinations without additional payment until he shall have passed such examination, subject, however, to rules of the commissioner of gas and electricity governing such examinations.

2778. Apprentices to moving picture operators—permits—fee—change of employment.) It shall be unlawful for any person to act as an apprentice to a moving picture operator in the handling, repairing, keeping or manipulating of a moving picture machine or device without first obtaining a permit from the commissioner of gas and electricity to act as such. Said commissioner of gas and electricity shall issue such permit upon the payment of a fee of ten dollars (\$10.00) to the city collector in case the applicant for same is not less than 16 years of age and presents to said commissioner of gas and electricity a letter from a regularly licensed moving picture operator and the proprietor of some place of amusement or other enterprise regularly licensed to conduct moving picture shows or operate moving picture machines or devices, which letter must state that such applicant for a permit, upon the issuance of a permit, will be regularly employed as an apprentice by the person writing such letter. Upon the issuance of such permit, which shall state the place of employment of the holder thereof, the person obtaining same may act as such apprentice and shall be permitted to enter the booth containing a moving picture machine or device at designated place of employment, but the operation of such machine or device shall not be conducted by him during an exhibition open to the public. Such permit shall not admit the holder thereof into the booth of any moving picture machine or device at any other place except the place of employment designated therein, and in case of a change of employment of such apprentice he shall be required to secure the approval of the commissioner of gas and electricity.

2779. Duties of commissioner of gas and electricity to examine operators—rules and regulations—records—annual report.) It shall be the duty of the commissioner of gas and electricity to examine all applicants duly qualified for licenses as moving picture operators in regard to their qualifications to operate moving picture machine and devices and also to pass on the qualifications of all applicants for permits to act as apprentices to licensed moving picture operators. The said commissioner of gas and electricity shall have power to adopt such reasonable rules

and regulations as to the time and manner of conducting examinations and the requirements thereof as will enable him to ascertain fully the competency, the record for efficiency and the fitness of each applicant. Said commissioner of gas and electricity shall keep a record of the issuance of licenses and the place of employment of each moving picture operator licensed hereunder and each apprentice to whom a permit has been issued as herein provided. Each operator shall notify the commissioner of gas and electricity promptly on transferring from one place of employment to another. For the purpose of such record every holder of such license or permit shall at once, in case of loss or of mislaying of his license or permit, report the same to said commissioner of gas and electricity, in writing, and in case of his transfer from one place of employment to another he shall also forthwith notify said commissioner of gas and electricity in writing. Said commissioner of gas and electricity shall annually, on or before the first day of March in each year, prepare and present to the mayor and city council a report showing all transactions during the previous fiscal year.

2780. Posting of license—permit to be exhibited—suspension and revocation.) Every moving picture operator who is licensed under the provisions of this article shall have his license posted in a conspicuous place in the box office of any place of entertainment where he may be engaged, or in case there is no box office, said license shall be posted in some other conspicuous place where the entertainment or exhibition is given, at all times during such engagement, and shall at all times while engaged in the operation of a moving picture machine or device have on his person, or on the premises where he is engaged, an identification card issued by the commissioner of gas and electricity, which card shall show the photograph and signature of the person to whom it is issued; and every apprentice who holds a permit as provided for in section 2778 hereof shall at all times while employed have same on his person or on the premises where he is employed, so that it may be exhibited to any officer or employee of the city authorized to inspect same. The commissioner of gas and electricity may, for any violation of the provisions of this article, or any rule or regulation of the department of gas and electricity, suspend the license of any moving picture operator or the permit of any apprentice, for a period not to exceed thirty (30) days. The mayor may revoke the license of any moving picture operator for the violation of any ordinance of the city relative to the use or operation of moving picture machines and devices, or if in his discretion the holder of such license is incompetent or unfit. The mayor may also revoke the permit of any apprentice to a moving picture operator at any time at his discretion. Whenever any license or permit shall be revoked or suspended, it shall be the duty of the holder thereof to forthwith surrender to the commissioner of gas and electricity his license or permit and identification card.

2781. Unlawful to enter booth—exception—number limited.) It shall be unlawful for any one other than a person licensed as a moving picture operator or holding a permit as an apprentice under the provisions of this article, or an officer or employee of the city while acting in the discharge of his duty, to enter any compartment or booth where a moving picture machine or device is in operation or to operate or in any way handle or manage such machine or device while the same is being operated during an exhibition; provided, that this section shall not apply to the proprietor, owner or manager in charge of the premises, who may enter same for the purpose of giving necessary orders and directions. In

Pierce Electric Company

ELECTRIC CONSTRUCTION IN ALL BRANCHES

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CHICAGO, ILLINOIS

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R. A. MORRISON
PAUL PIERCE

no case shall more than four persons be with-
in such compartment or booth at one time
while such exhibition is going on.

2782. **Penalty.)** Any person violating any
of the provisions of this article or failing to
comply with same shall be fined not less than
five dollars (\$5.00) nor more than fifty dollars
(\$50.00) for each and every offense, and each
day's violation hereof shall be considered a
separate offense.

Section 9. This ordinance shall take effect
and be in force from and after its passage.

which permit shall be countersigned by the
commissioner of gas and electricity, under a
penalty of one hundred dollars (\$100) for each
and every offense; and each and every day
that such pole, line or wire, or electric con-
ductor shall be maintained or used after the
first conviction shall be deemed a separate
and distinct offense.

3771. **Requirement before permits can be
issued.)** All applications for permits to erect
poles in the streets and alleys of the city

Table 1. Allowable Carrying Capacities of Wires.

Gauge No.	Diameter of Solid Wires in Mils.	Area in Circular Mils.	Column A Rubber Insulation Amperes	Column B Varnished Cambric Insulation Amperes	Column C Other Insulation Amperes
18	40.3	1,624	3	.....	5
16	50.8	2,583	6	.....	10
14	64.1	4,107	15	18	20
12	80.8	6,530	20	25	25
10	101.9	10,380	25	30	30
8	128.5	16,510	35	40	50
6	162.0	26,250	50	60	70
5	181.9	33,100	55	65	80
4	204.3	41,740	70	85	90
3	229.4	52,630	80	95	100
2	257.6	66,370	90	110	125
1	289.3	83,690	100	120	150
0	325.0	105,500	125	150	200
00	364.8	133,100	150	180	225
000	409.6	167,800	175	210	275
.....	.....	200,000	200	240	300
0000	460.0	211,600	225	270	325
.....	.....	250,000	250	300	350
.....	.....	300,000	275	330	400
.....	.....	350,000	300	360	450
.....	.....	400,000	325	390	500
.....	.....	500,000	400	480	600
.....	.....	600,000	450	540	680
.....	.....	700,000	500	600	760
.....	.....	800,000	550	660	840
.....	.....	900,000	600	720	920
.....	.....	1,000,000	650	780	1,000
.....	.....	1,100,000	690	820	1,080
.....	.....	1,200,000	730	880	1,150
.....	.....	1,300,000	770	920	1,220
.....	.....	1,400,000	810	970	1,290
.....	.....	1,500,000	850	1,020	1,360
.....	.....	1,600,000	890	1,070	1,430
.....	.....	1,700,000	930	1,120	1,490
.....	.....	1,800,000	970	1,160	1,550
.....	.....	1,900,000	1,010	1,210	1,610
.....	.....	2,000,000	1,050	1,260	1,670

1 Mil.—0.001 inch.

**SECTIONS OF THE CHICAGO MUNICIPAL
CODE OF 1922 GOVERNING ELECTRICAL
CONSTRUCTION IN STREETS AND
ALLEYS**

CHAPTER LXXVII

Streets

ARTICLE X

Poles, Wires and Conductors

3770. **Permit to erect required—penalty.)**
No person, firm or corporation shall erect,
construct, maintain, use, alter or repair any
pole, line or wire, underground conductors or
electric conductors of any description what-
ever on, over or under any street, sidewalk,
avenue, alley or public place within the city,
without first having obtained a permit there-
for from the commissioner of public works,

shall provide that the city may use the poles
to be so erected and may attach thereto such
necessary cross arms, wires or other electri-
cal appliances as may be deemed necessary
for the electrical service of the city, and no
permit shall be issued by the commissioner of
public works for the erection of such poles in
which the application and permit does not
provide for the privileges required by the city
as herein contained.

Applications for permits shall be made in
duplicate on a form to be approved by the
commissioner of public works and the com-
missioner of gas and electricity.

One copy of the application shall be sub-
mitted to the commissioner of public works
and one copy to the commissioner of gas and
electricity, each of whom shall cause the nec-
essary inspections to be made.

3772. **Fees.)** A fee of two dollars shall be
charged for each permit issued by the com-



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missioner of public works for the erection of poles, lines or wires, or electric conductors of any description whatever, or for any laying of underground electrical conduits or the placing of conductors therein.

Said fees shall be demanded by the commissioner of gas and electricity before he countersigns any such permit, and shall be paid to the city collector.

611. Non-Metallic Sheathed Cable.

For installation, see Section 507 and appendix note 507.

a. The conductor shall comply with the requirements for rubber-covered wires, except that no braid need be provided directly over the rubber covering.

b. Cable shall be of approved type, in sizes 14 to 10, inclusive, and in two or three-wire assemblies and in addition may have an approved size of non-insulated copper conductor laid in next to the insulated conductor for grounding purposes.

c. The cable shall have a continuous distinctive marker so that the maker may be readily identified.

612. Carrying Capacity of Conductors.

a. The following tables give the allowable continuous current carrying capacities of copper wires and cables of 98 per cent conductivity, according to the standard adopted by the American Institute of Electrical Engineers.

b. For aluminum wire the allowable carrying capacities shall be taken as 84 per cent of those given in the table for the respective sizes of copper wire with the same kind of covering.

c. Conductors of size Nos. 18 and 16 shall be used only for flexible cords and for fixture wires.

d. Conductors of the same size of less than 400,000 C.M. may be placed in mul-

tle only by permission of the bureau of electrical inspection.

e. Varnished cambric insulated wires smaller than No. 6 shall be used only under a special permit issued by the bureau of electrical inspection.

613. Size of Feeders and Sub-Feeders for Apartment Buildings.

Demand Factor. The demand factor of any system or part of a system, is the ratio of the maximum demand of the system, or part of a system, to the total connected load of the system, or of the part of the system under consideration.

a. To estimate the size of feeders and sub-feeders for apartment buildings, the sum of the following three factors shall be considered the total watt load:

See Appendix Note 613, page —, Table for size of wires for feeders and sub-feeders for apartment buildings.

Factor 1—Apartment Lighting Load—the total floor space, including partitions, shall be estimated as one watt per square foot. Should the layout or design of the apartment lighting load in watts, exceed that estimated on the basis of one watt per square foot, then the lighting load shall be estimated on the actual watt load to be connected.

Factor 2—The appliance load shall be estimated as 1,000 watts per apartment, to which shall be added the watt load of any appliance over 660 watts rating intended to be connected and used in the apartment.

Factor 3—The public halls and basements watt load shall be estimated as 60 watts per outlet, except that for outlets to be used for appliances, the watt load of such appliances shall be added.

The estimated maximum demand shall be the sum of the three above factors multiplied by a demand factor in the following table corresponding to the number of apartments wired.

NOTE 613. SIZE OF WIRE FOR FEEDERS AND SUB-FEEDERS FOR APARTMENT BUILDINGS.

110-220 Volt, 3-Wire Mains. D.C. and Single Phase.

Wire Size	D. F. 100%	1 to 5 Apts. D. F. 75%	6 to 10 Apts. D. F. 71.25%	11 to 15 Apts. D. F. 67.5%	16 to 25 Apts. D. F. 63.75%	26 to 35 Apts. D. F. 60%	Above 35 Apts. D. F. 56.25%
Load in Watts—Before Using Above Demand Factors.							
	Watts	Watts	Watts	Watts	Watts	Watts	Watts
14	3,300	4,400	4,631	.....	.....	.....	.....
12	4,400	5,867	6,174	.....	.....	.....	.....
10	5,500	7,333	7,719	.....	.....	.....	.....
8	7,700	10,267	10,807	.....	.....	.....	.....
6	11,000	14,667	15,437	16,296	17,255	.....	.....
4	15,400	20,533	21,614	22,814	24,157	.....	.....
3	17,600	23,467	24,701	26,074	27,608	29,333	.....
2	19,800	26,400	27,789	29,333	31,059	33,000	.....
1	22,000	29,333	30,877	32,593	34,510	36,666	39,111
0	27,500	36,667	38,596	40,741	43,137	45,833	48,889
00	33,000	44,000	46,310	48,888	51,765	55,000	58,667
000	38,500	51,333	54,035	57,037	60,392	64,167	68,444
0000	49,500	66,000	69,473	73,333	77,647	82,500	88,000
250	55,000	73,333	77,190	81,481	86,274	91,667	97,778
300	60,500	80,667	84,910	89,629	94,902	100,833	107,556
350	66,000	.....	92,630	97,777	103,529	110,000	117,333
400	71,500	105,925	110,888	119,166	127,111
500	88,000	128,039	146,666	156,444
600	99,000	165,000	176,000



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No. of Apartments	D. F.
1 to 5.....	75.00%
6 to 10.....	71.25%
11 to 15.....	67.50%
16 to 25.....	63.75%
26 to 35.....	60.00%
36 or more.....	56.25%

DIRECTIONS FOR USING ABOVE TABLE

Note: The estimated load shall first be computed as in Section 613, Page 92.

Rule—Select the column whose heading refers to the number of apartments directly served by this feeder.

Note the number in this column which is equal to, or next greater than the estimated connected load.

Find the feeder wire size on the same line to the left, and in the first column.

Example: Required (feeder wire size?) for 6 apartments, area of 600 square feet each. Appliance load of 1000 watts per apartment, and 10 public lights at 60 watts each, thus the estimated connected load in watts is:

Factor 1—6 apts. x 600 watts (1 sq. ft. equivalent to 1 watt).....3600

Factor 2—6 apts x 1000 watts (requirement for tenants appliance load)...6000

Factor 3—10 public lights @ 60 watts each..... 600

Total Estimated Connected Load in Watts.....10200

Solution: The column selected is the one headed "6 to 10 Apartments." The number noted in this column is 10,807. The feeder wire size is found to be No. 8.

WHEN OTHER LOADS ARE COMBINED WITH APARTMENT LOADS

Stores, etc. may be connected to apartment feeders, but in such cases the demand factor for the apartment loads are not to be applied to the other loads. The above table, however, may be used to find the feeder wire size. Proceed first only with the estimated connected load for the apartments, following the above rule except that the wire size is not taken; instead, note the watts number on the same line and in the second column.

This figure is equal to, or next higher than the estimated maximum demand in watts for the apartment load. Next, obtain the corresponding estimated maximum demand, for each other load using the appropriate demand (factor of 100%) for each such load; add these demands to the apartment demand and then note the number in the second column, which is equal to or next higher than this sum. Find the feeder wire size on the same line and in the first column.

Example: Find size of feeder for 6 apartments, having the same floor area and number of public lights as in the preceding example and 6 stores with a load (estimated according to Section 613) of 54,000 watts.

No demand factor is allowed on commercial loads, the estimated load is the demand load.

For the apartment portion of this load, we found in the first example of the feeder wire size to be No. 8 or a demand load of 7700 watts. Add these two demand loads—thus:

Commercial54,000 watts
Apartment 7,700 watts

Total demand load....61,700 watts

Referring this total to the second column of the table under "watts" we find the next higher load to be 66,000 watts, requiring a 350,000 c.m. service and main feeder.

The minimum size for service wires shall be No. 8 (See Section 404).

Where feeders are to serve loads other than apartments, such loads shall be computed by the use of the proper demand factor and shall be added to the estimated maximum demand of the apartment feeders.

b. In the wiring of stores, feeders and sub-feeders shall be provided on a basis of two watts per square foot of sales space; 100 watts capacity per lineal foot of show windows measured horizontally along the base of the show window and a further allowance of 1500 watts capacity for store for sign. Demand factor for store feeders 100%.

c. In the wiring of office buildings, feeders and sub-feeders shall be provided on a basis of 2 watts per square foot. For areas 10,000 square feet or less per feeder—demand 100%. For all excess above 10,000 square feet per feeder—demand 70% minimum.

d. The sizes of feeders supplying electrically heated cooking and baking appliances, each rated at more than 1650 watts, may be determined on the basis of the demand values shown in the following table:

Number Ranges	Demand Factor	Number Ranges	Demand Factor
1.....	100	14.....	43
2.....	100	15.....	40
3.....	95	16.....	39
4.....	90	17.....	38
5.....	85	18.....	37
6.....	80	19.....	36
7.....	75	20.....	35
8.....	65	21.....	34
9.....	55	22.....	33
10.....	52	23.....	32
11.....	48	24.....	31
12.....	46	25.....	30
13.....	44	Over 25.....	30

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Bowman Dairy Co.

Alfred Decker & Cohn

International Harvester Co.

Hart, Shaffner & Marx

ALLOWABLE CARRYING CAPACITIES OF WIRES

B. & S. Gage	Diam. of Solid Wires in Mils	Area in Circular Mils	Table A Rubber Insulation Amperes	Table C Other Insulation Amperes
18	40.3	1,624	3	5
16	50.8	2,583	6	10
14	64.1	4,107	15	20
12	80.8	6,530	20	25
10	101.9	10,380	25	30
8	128.5	16,510	35	50
6	162.0	26,250	50	70
5	181.9	33,100	55	80
4	204.3	41,740	70	90
	229.4	52,630	80	100
3				
2	257.6	66,370	90	125
1	289.3	83,690	100	150
0	325	105,500	125	200
00	364.8	134,100	150	225
000	409.6	167,800	175	275
0000	460	200,000	200	300
		211,600	225	325
		230,000	250	350
		300,000	275	400
		350,000	300	450
		400,000	325	500
		500,000	400	600
		600,000	450	680
		700,000	500	760
		800,000	550	840
		900,000	600	920
		1,000,000	650	1,000
		1,100,000	690	1,080
		1,200,000	730	1,150
		1,300,000	770	1,220
		1,400,000	810	1,290
		1,500,000	850	1,360
		1,600,000	890	1,430
		1,700,000	930	1,490
		1,800,000	970	1,550
		1,900,000	1,010	1,610
		2,000,000	1,050	1,670

1 mil = 0.001 inch.

SIZE OF CONDUIT FOR THE INSTALLATION OF WIRES AND CABLES RUBBER COVERED WIRES

Size of Wire	Number of Wires in One Conduit								
	1	2	3	4	5	6	7	8	9
	Minimum Size of Conduit in Inches								
14	1/2	1/2	1/2	3/4	1	1	1	1	1 1/4
12	1/2	1/2	1/2	3/4	1	1	1	1	1 1/4
10	1/2	1/2	1/2	3/4	1	1	1 1/4	1 1/4	1 1/4
8	1/2	1/2	1/2	1	1	1 1/4	1 1/4	1 1/4	1 1/4
6	3/4	1	1 1/4	1 1/4	1 1/2	2	2	2	2 1/4
5	3/4	1	1 1/4	1 1/4	1 1/2	2	2	2	2 1/4
4	3/4	1 1/4	1 1/4	1 1/2	2	2	2 1/2	2 1/2	2 1/2
3	3/4	1 1/4	1 1/4	1 1/2	2	2	2 1/2	2 1/2	2 1/2
2	3/4	1 1/4	1 1/4	1 1/2	2	2	2 1/2	2 1/2	2 1/2
1	1	1 1/2	1 1/2	2	2 1/2	2 1/2	3	3	3 1/2
0	1	1 1/2	2	2 1/2	2 1/2	3	3	3	3 1/2
00	1	2	2	2 1/2	2 1/2	3	3	3 1/2	3 1/2
000	1	2	2	2 1/2	2 1/2	3	3	3 1/2	3 1/2
0000	1 1/4	2	2 1/2	2 1/2	3	3	3 1/2	3 1/2	4
200000C.M.	1 1/4	2 1/2	2 1/2	2 1/2	3	3	3 1/2	3 1/2	4
225000	1 1/4	2 1/2	2 1/2	2 1/2	3	3	3 1/2	3 1/2	4
250000	1 1/4	2 1/2	2 1/2	3	3	3 1/2	3 1/2	3 1/2	4
300000	1 1/4	2 1/2	3	3	3 1/2	3 1/2	3 1/2	3 1/2	4
350000	1 1/4	2 1/2	3	3 1/2	3 1/2	4	4	4	4 1/2
1000000	1 1/4	3	3	3 1/2	3 1/2	4	4	4	4 1/2
1500000	1 1/2	3	3	3 1/2	3 1/2	4	4 1/2	4 1/2	5
5000000	1 1/2	3	3 1/2	4	4 1/2	5	5	5	5 1/2
6000000	2	3	3 1/2	4	4 1/2	5	5	5	5 1/2
6500000	2	3 1/2	3 1/2	4	4 1/2	5	5	5	5 1/2
7000000	2	3 1/2	3 1/2	4 1/2	4 1/2	5	5	5	5 1/2
7500000	2	3 1/2	4	4 1/2	4 1/2	5	5	5	5 1/2
8000000	2	3 1/2	4	4 1/2	4 1/2	5	5	5	5 1/2
8500000	2	3 1/2	4	4 1/2	4 1/2	5	5	5	5 1/2
9000000	2	3 1/2	4	4 1/2	4 1/2	5	5	5	5 1/2
9500000	2	4	4	4 1/2	4 1/2	5	5	5	5 1/2
10000000	2	4	4	4 1/2	4 1/2	5	5	5	5 1/2
11000000	2 1/2	4	4 1/2	4 1/2	5	5	5	5	5 1/2
12000000	2 1/2	4 1/2	4 1/2	4 1/2	5	5	5	5	5 1/2
12500000	2 1/2	4 1/2	4 1/2	4 1/2	5	5	5	5	5 1/2
13000000	2 1/2	4 1/2	4 1/2	4 1/2	5	5	5	5	5 1/2
14000000	2 1/2	4 1/2	4 1/2	4 1/2	5	5	5	5	5 1/2
15000000	2 1/2	4 1/2	4 1/2	4 1/2	5	5	5	5	5 1/2
16000000	2 1/2	4 1/2	4 1/2	4 1/2	5	5	5	5	5 1/2
17000000	2 1/2	4 1/2	4 1/2	4 1/2	5	5	5	5	5 1/2
17500000	2 1/2	4 1/2	4 1/2	4 1/2	5	5	5	5	5 1/2
18000000	2 1/2	4 1/2	4 1/2	4 1/2	5	5	5	5	5 1/2
19000000	2 1/2	4 1/2	4 1/2	4 1/2	5	5	5	5	5 1/2
20000000	2 1/2	4 1/2	4 1/2	4 1/2	5	5	5	5	5 1/2

* Where single conductor, single braid, solid wires only, are used, four No. 14 wires may be installed in a 1/2 inch conduit and up to seven No. 14 wires in a 3/4 inch conduit. Three No. 12 wires may be installed in a 1/2 inch conduit, four No. 10 wires in a 3/4 inch conduit and three No. 8 wires in a 3/4 inch conduit.

WIRES IN CONDUIT.—For combinations of wires not shown in the Chicago Electrical Code, the following tables may be used to determine the proper size conduit. The combined area of the wires should never exceed 40 per cent. of the area of the conduit. This table must only be used where there are more than three wires in the conduit. Special permission must be obtained for the installation of more wires than are shown in Table headed "Number of Wires in Conduit."

Support of Wires in Vertical Conduits.

Wires in vertical conduits shall be supported at the following intervals:

		not greater than
No. 14	to No. 0	.... 100 ft.
No. 00	to No. 0000	.... 80 ft.
No. 0000	to 350000 C. M.	.... 60 ft.
350001 C. M.	to 500000 C. M.	.... 50 ft.
500001 C. M.	to 750000 C. M.	.... 40 ft.
Above 750000 C. M.		.... 35 ft.

The following methods of supporting cables are recommended:

1. By approved clamping devices constructed of or employing insulating wedges inserted in the ends of the conduits.

2. By inserting junction boxes at the required intervals in which insulating supports of approved type are installed and secured in a satisfactory manner to withstand the weight of the conductors attached thereto, the boxes being provided with covers.

3. In approved junction boxes, by deflecting the cables not less than 90 degrees and carrying them horizontally to a distance not less than twice the diameter of the cable, the cables being carried on two or more insulating supports, and additionally secured thereto by the wires if desired.

Size of Ground Wire and Size of Ground Conduit for Grounding Circuit.

Size of Largest Wire	Size of Ground Wire	Size of Ground Conduit
10	10	1/2 inch
8	8	1/2 inch
6	8	1/2 inch
4	8	1/2 inch
3	8	1/2 inch
2	8	1/2 inch
1	8	1/2 inch
0	8	1/2 inch
00	8	1/2 inch
000	8	1/2 inch
0000	8	1/2 inch
00000	8	3/4 inch
200,000	4	3/4 inch
400,000	4	3/4 inch
500,000	4	3/4 inch
600,000	2	3/4 inch
700,000	1	3/4 inch
800,000 and above	0	1 inch

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Size of Wire	Maximum Number of Wires in Conduit					
	Inch 1	Inch 1 1/4	Inch 1 1/2	Inch 2	Inch 2 1/2	Inch 3
14	11	19	26	43	61	95
12		15	21	34	50	77
10		12	16	27	38	60
8			13	22	31	49
6					14	22

SIZE OF CONDUIT FOR THE INSTALLATION OF WIRES AND CABLES

Lead Covered Wires (0-600 Volts) (Single Conductors)

Size of Wire	Outside Diam. 64th	Diam. Dec. Equiv.	Number of Conductors in One Conduit			
			1	2	3	4
			Minimum Size of Conduit in Inches			
14	18	.281	1 1/2	3/4	1	1
12	20	.312	1 1/2	3/4	1	1 1/4
10	23	.359	1 1/2	1	1	1 1/4
8	25	.39	1 1/2	1	1 1/4	1 1/4
6	30	.47	1 1/2	1 1/4	1 1/4	1 1/2
5	32	.50	1 1/2	1 1/4	1 1/4	1 1/2
4	33	.51	1 1/2	1 1/4	1 1/2	2
3	35	.55	1 1/2	1 1/2	2	2
2	37	.58	1 1/2	2	2	2 1/2
1	41	.64	1 1/2	2	2	2 1/2
1/0	44	.68	1 1/2	2	2	2 1/2
2/0	47	.73	1 1/2	2	2	2 1/2
3/0	50	.78	1 1/2	2	2 1/2	3
4/0	54	.84	1 1/2	2 1/2	2 1/2	3
250,000	62	.97	1 1/2	3	3	3 1/2
300,000	65	1.01	1 1/2	3	3	3 1/2
350,000	68	1.06	1 1/2	3	3	3 1/2
400,000	71	1.11	1 1/2	3	3 1/2	4
450,000	74	1.15	1 1/2	3	3 1/2	4
500,000	78	1.21	2	3 1/2	3 1/2	4
550,000	86	1.34	2	3 1/2	4	4 1/2
600,000	88	1.37	2	3 1/2	4	4 1/2
650,000	90	1.40	2	4	4	5
700,000	92	1.43	2	4	4	5
750,000	94	1.47	2	4	4	5
800,000	96	1.50	2 1/2	4	4 1/2	5
850,000	99	1.55	2 1/2	4	4 1/2	5
900,000	100	1.56	2 1/2	4 1/2	4 1/2	5
950,000	102	1.59	2 1/2	4 1/2	4 1/2	6
1,000,000	105	1.64	2 1/2	4 1/2	4 1/2	6
1,250,000	116	1.81	3	5	5	6
1,500,000	126	1.97	3	5	5	6
1,750,000	136	2.12	3	6	6	6
2,000,000	142	2.21	3	6	6	6

Dimensions of Rubber-Covered Wire.

Wire	Area	Wire	Area	Wire	Area
14	.031	225,000 C.M.	.55	1,000,000 C.M.	1.74
12	.038	250,000 C.M.	.58	1,100,000 C.M.	2.04
10	.049	300,000 C.M.	.69	1,200,000 C.M.	2.16
8	.06	350,000 C.M.	.77	1,250,000 C.M.	2.22
6	.13	400,000 C.M.	.83	1,300,000 C.M.	2.27
5	.15	450,000 C.M.	.92	1,400,000 C.M.	2.40
4	.17	500,000 C.M.	.99	1,500,000 C.M.	2.52
3	.19	550,000 C.M.	1.11	1,600,000 C.M.	2.63
2	.21	600,000 C.M.	1.19	1,700,000 C.M.	2.78
1	.27	650,000 C.M.	1.27	1,750,000 C.M.	2.85
0	.31	700,000 C.M.	1.33	1,800,000 C.M.	2.89
.00	.36	750,000 C.M.	1.39	1,900,000 C.M.	3.05
.000	.42	800,000 C.M.	1.45	2,000,000 C.M.	3.11
.0000	.49	850,000 C.M.	1.54		
		900,000 C.M.	1.60		
		950,000 C.M.	1.68		

Dimensions of Conduit.

Conduit	Area	40% of Area	Conduit	Area	40% of Area
1 1/2	306	122	3	7.34	2.93
3/4	516	206	3 1/2	9.94	3.97
1	848	339	4	12.7	5.08
1 1/4	1.19	596	4 1/2	15.9	6.36
1 1/2	2.03	812	5	19.9	7.96
2	3.32	1.328	6	28.8	11.52
2 1/2	4.75	1.9			

Example: What size conduit is required for 6 No. 6 and 4 No. 2, B. & S. gage R. C. wires? $6 \times .13 = .78$, $4 \times .21 = .84$, or a total area of 1.62. In the column headed "40% of Area" it will be found that a 2 1/2" conduit is required.

DIRECT CURRENT MOTORS—110 VOLTS

SIZE OF WIRE FOR BRANCHES OR MAINS SUPPLYING ONE MOTOR ONLY.

Horse Power	Full Load Current	Size of Wire One Motor	Size of Conduit	Size of Fuse	Size of Switch
1	8	14	1 1/2	10	30
2	15	12	1 1/2	20	30
3	23	8	1 1/2	30	40
4	30	6	1	40	60
5	38	6	1	50	60
7.5	56	4	1 1/4	70	100
10	75	1	1 1/2	95	100
12.5	94	0	1 1/2	120	200
15	113	00	2	150	200
17.5	131	0000	2	175	200
20	150	0000	2	200	200
		c. m.			
25	188	250	2 1/2	250	400
30	225	300	2 1/2	300	400
35	263	400	3	325	400
40	300	500	3	375	400
45	338	600	3	425	600
50	375	700	3 1/2	475	600
55	413	800	3 1/2	525	600
60	450	800	3 1/2	575	600
65	488	900	3 1/2	600	800
70	525	1000	4	650	800
75	563	1100	4	700	800
80	600	1300	1 1/2	750	800
85	638	1400	4 1/2	800	800
90	675	1500	4 1/2	850	1000
95	713	1600	5	900	1000
100	750	1700	5	950	1000
125	938	2-900	2-3 1/2	1175	1200
150	1125	2-1100	2-4	1400	1500
200	1500	2-1700	2-6	1875	C. B.
250	1875	3-1300	2-5	2350	C. B.
300	2250	3-1700	2-5	2800	C. B.

Column headed "Size of Wire, One Motor," gives size of wire for branches and for mains supplying one motor and is based on the 25% overload required by the rules.

The question of drop is not taken into account in these tables.

Double-pole switches over 1500 amperes not permitted. Circuit-breakers or oil switches must be used.

Fuses must not be larger than 125% of motor rating.

Where fuses larger than 600 amperes are required fuses may be used in multiple. The least possible number of fuses must be used in such cases and the fuses must be of equal capacity.

INDIANAPOLIS

CLEVELAND

HATFIELD ELECTRIC COMPANY

ELECTRICAL CONTRACTORS



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CHICAGO

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DIRECT CURRENT MOTORS—220 VOLTS.
SIZE OF WIRE FOR BRANCHES OR
MAINS SUPPLYING ONE MOTOR ONLY.

Horse Power	Full Load Current	Size of Wire One Motor	Size of Conduit	Size of Fuse	Size of Switch
1	4	14	$\frac{1}{2}$	5	30
2	8	14	$\frac{1}{2}$	10	30
3	12	14	$\frac{1}{2}$	15	30
4	15	12	$\frac{1}{2}$	20	30
5	19	10	$\frac{3}{8}$	25	30
7 5	28	8	$\frac{3}{8}$	35	60
10	38	6	1	50	60
12 5	47	4	$1\frac{1}{8}$	60	60
15	56	4	$1\frac{1}{8}$	70	100
17 5	65	3	$1\frac{1}{8}$	80	100
20	75	1	$1\frac{1}{2}$	95	100
25	94	0	$1\frac{1}{2}$	120	200
30	113	00	2	150	200
35	131	000	2	175	200
40	150	0000	2	200	200
45	169	0000	2	225	400
50	188	c. m.	$2\frac{1}{2}$	250	400
55	206	300	$2\frac{1}{2}$	250	400
60	225	300	$2\frac{1}{2}$	300	400
65	244	350	$2\frac{1}{2}$	300	400
70	263	400	3	325	400
75	281	500	3	350	400
80	300	500	3	375	400
85	319	500	3	400	400
90	338	600	3	425	600
95	356	600	3	450	600
100	375	700	$3\frac{1}{2}$	475	600
125	463	900	$3\frac{1}{2}$	575	600
150	563	1100	4	700	800
200	750	1700	5	950	800
250	938	2-900	$2-3\frac{1}{2}$	1175	1200
300	1125	2-1100	2-4	1400	1500

Column headed "Size of Wire, One Motor," gives size of wire for branches and for mains supplying one motor and is based on the 25% overload required by the rules.

The question of drop is not taken into account in these tables.

Fuses must not be larger than 125% of motor rating.

Where fuses larger than 600 amperes are required, fuses may be used in multiple. The least possible number of fuses must be used in such cases and the fuses must be equal in capacity.

THREE-PHASE MOTORS—220 VOLTS.
SIZE OF WIRE FOR BRANCHES OR
MAINS SUPPLYING ONE MOTOR ONLY.

Horse Power	Full Load Current	Size of Wire One Motor	Size of Conduit	Running Fuse	Starting Fuse	Motor Switch	Service Switch
1	3	14	$\frac{1}{2}$	10	10	30	30
2	6	14	$\frac{1}{2}$	10	20	30	30
3	9	14	$\frac{1}{2}$	15	30	30	30
4	13	12	$\frac{1}{2}$	20	40	30	60
5	19	10	$\frac{3}{8}$	30	60	30	60
7 1/2							
10	26	8	$\frac{3}{8}$	40	65	60	100
15	38	6	$1\frac{1}{8}$	50	80	60	100
20	51	4	$1\frac{1}{8}$	70	100	100	100
25	64	3	$1\frac{1}{8}$	80	125	100	200
30	77	1	$1\frac{1}{2}$	100	150	100	200
35	90	0	2	125	200	200	200
40	102	00	2	150	200	200	200
45	115	00	2	150	250	200	400
50	128	000	2	175	250	200	400
55	141	000	2	200	300	200	400
60	154	0000	$2\frac{1}{2}$	200	300	200	400
65	166	0000	$2\frac{1}{2}$	225	350	200	400
70	179	0000	$2\frac{1}{2}$	225	350	400	400
75	192	250	$2\frac{1}{2}$	250	400	400	400
80	205	300	3	275	425	400	600
85	218	300	3	275	450	400	600
90	230	350	3	300	475	400	600
95	243	350	3	325	500	400	600
100	256	400	3	325	500	400	600
125	320	500	3	400	650	400	800
150	384	700	$3\frac{1}{2}$	500	750	600	800
200	512	2-400	2-3	650	1025	800	1200
250	640	2-500	2-3	800	1300	800	1500
300	768	2-700	2-3 1/2	1000	1550	1000	1500

Column headed "Size of Wire, One Motor," gives size of wire for branches and for mains supplying one motor and is based on the 25% overload required by the rules.

The question of drop is not taken into account in these tables.

This table is figured on a basis of 85% power factor and 90% efficiency, or 2.56 amperes per horsepower. Motors of horsepower not shown in the table may be calculated on this basis allowing 25% overload for circuits supplying one motor.

The motor switch must not be smaller than 125% of the rating of the motor. Running fuses must not be larger than 125% of the rated current of the motor and starting fuses of a capacity of 300% of the rated current for motors of 1 to 5 horsepower, 250% for motors from 6 to 10 horsepower and 200% for motors above 10 horsepower will be permitted.

THREE-PHASE MOTORS—440 VOLTS.
SIZE OF WIRE FOR BRANCHES OR
MAINS SUPPLYING ONE MOTOR ONLY.

Horse Power	Full Load Current	Size of Wire One Motor	Size of Conduit	Running Fuse	Starting Fuse	Motor Switch	Service Switch
1	2	14	$\frac{1}{2}$	5	10	30	30
2	3	14	$\frac{1}{2}$	5	10	30	30
3	4	14	$\frac{1}{2}$	10	15	30	30
4	6	14	$\frac{1}{2}$	10	20	30	30
5	9	14	$\frac{1}{2}$	15	30	30	30
7 1/2							
10	13	12	$\frac{1}{2}$	20	35	30	60
15	19	10	$\frac{3}{8}$	25	50	60	60
20	25	8	$\frac{3}{8}$	35	65	60	100
25	32	6	$1\frac{1}{8}$	40	80	60	100
30	38	6	$1\frac{1}{8}$	50	75	60	100
35	45	4	$1\frac{1}{8}$	60	90	60	100
40	51	4	$1\frac{1}{8}$	65	100	100	100
45	57	4	$1\frac{1}{8}$	75	110	100	200
50	64	3	$1\frac{1}{8}$	80	125	100	200
55	70	2	$1\frac{1}{2}$	90	150	100	200
60	77	1	$1\frac{1}{2}$	95	150	100	200
65	83	0	2	100	175	100	200
70	89	0	2	110	200	200	200
75	96	0	2	125	200	200	200
80	102	00	2	125	200	200	200
85	109	00	2	150	225	200	400
90	115	00	2	150	225	200	400
95	121	000	2	150	250	200	400
100	128	000	2	175	250	200	400
125	160	000	2	200	325	200	400
150	192	250 c m	$2\frac{1}{2}$	250	375	400	400
200	256	400 c m	3	325	500	400	600
250	320	500 c m	3	400	650	400	800
300	384	700 c m	$3\frac{1}{2}$	475	775	600	800

Column headed "Size of Wire, One Motor," gives size of wire for branches and for mains supplying one motor and is based on the 25% overload required by the rules.

The question of drop is not taken into account in these tables.

This table is figured on a basis of 85% power factor and 90% efficiency, or 1.28 amperes per horsepower. Motors of horsepower not shown in the table may be calculated on this basis, allowing 25% overload for circuits supplying one motor.

The motor switch must not be smaller than 125% of the rating of the motor. Running fuses must not be larger than 125% of the rated current of the motor and starting fuses of a capacity of 300% of the rated current for motors of 1 to 5 horsepower, 250% for motors from 6 to 10 horsepower and 200% for motors above 10 horsepower will be permitted.

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RULES AND INFORMATION PERTAINING TO ELECTRIC SERVICE, METERS AND WIRING OF COMMONWEALTH EDISON CO.

See Special Ruling on Page 407

STANDARD FORMS OF SERVICE.

1. The Company's standard service for light and power is available in different forms, the kind of service available depending upon the locality and the amount of energy required, as follows:

2. Direct current, 3-wire, low tension Edison service at approximately 115-230 volts, available for light and power, only within the district boundaries shown on the map on next page. On any installation coming within the shaded portions, or close to the boundary lines of these portions, the customer must consult the Distribution Division of the Company, in order to ascertain the kind of service available, as these shaded territories are at present being served partially from direct current system but are being changed to alternating current service as rapidly as the company's lines can be extended. This consultation is also necessary because near the boundaries, direct and alternating current lines overlap in some places, and, in addition, the boundary lines are from time to time subject to change.

3. Alternating current, sixty cycle, single phase, 3-wire, low tension, transformed service, approximately 115-230 volts, is available for light and power (5 H. P. or less) outside of the boundaries of the direct current district, where the Company has single phase mains.

4. Where the Company has 3-phase mains, alternating current, sixty cycle, 3-phase, 3-wire, low tension transformed service, at approximately 230 volts, is available for power service for motors of 5 H. P. and larger, 3-phase service, at approximately 460 volts, will be furnished upon request for power installations having an aggregate rated motor capacity of 250 H. P. or more.

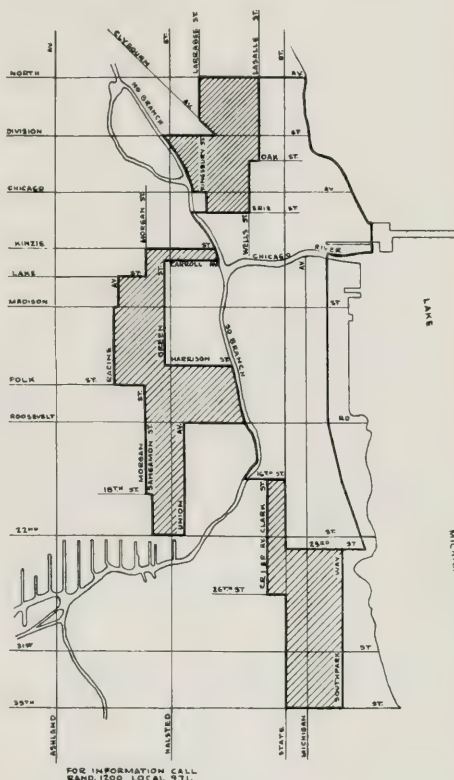
5. Under special conditions, other voltages on the alternating current, 60-cycle system are available, information regarding which may be had upon application to the Company.

6. When service is desired at locations where the Company has no lines or where its lines are not suitable for the class of service desired, a line extension must be arranged for. In such cases the Company will, upon receipt of advice as to the class of service and amount of energy desired, have an estimate prepared of the cost of installing the necessary line extension. If the estimated cost of the proposed line extension is in excess of the cost of a "free extension" as provided by the rules of the Illinois Commerce Commission, the excess cost of the extension must be deposited with the Company by the applicant or applicants.

7. The Company will not be responsible for mistakes of any kind whatsoever which may result from information given orally on the character of its service or the location of its main, unless such information is confirmed in writing.

SERVICE CONNECTIONS. Overhead.

2. The Company will provide at its own expense, for any customer, one overhead service drop for light and, where required by these rules, one overhead service drop for power. The length of this service drop shall in no case exceed 115 feet. Where the length of the service drop exceeds the amount allowed by the Company, a pole must be provided for each 110 feet or fraction thereof, provided, however, that where, due to special conditions, such a span is impossible, single spans between poles may be increased to 125



feet in length. The pole must be of cedar, at least 25 feet in length, with a minimum diameter of 6 inches at the top and set in the ground at least 4 1/2 feet. A square timber will not be approved as an intermediate support in place of a pole.

If, in order to give a better appearance, a steel pole is desired, this should be a two-section tubular steel pole, made up of two lengths of standard steel tubing, having nominal diameters of 4 in. and 5 in. The tubes should be joined by a swedge joint. Where the length of the service drop and the service conductors are 3 No. 6 wires or less a single piece of 4-inch standard pipe 20 feet long may be used. These poles must be set in a concrete collar, at least 12 inches in diameter. At the top of the pole, drillings are to be made and a standard spool-type bracket must be mounted in the proper position. This bracket is to be 2 or 3 wire, depending on the character of the customer's installation.

The requirements in the above paragraphs refer to the installation of service connections which do not require a service in excess of the excess of 6 No. B. & S. gauge wires. On installations requiring a service in excess of the above, the Distribution Division of the Company must be consulted for specifications covering the length of spans between poles and the size of poles.

POST ELECTRIC COMPANY

Contractors & Engineers

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Phone Central 4818

4. Service outlets should never be more than thirty (30) feet nor less than ten (10) feet from the ground. For buildings of two or more stories in height, the outlet should be brought out at the ceiling of the second floor.

6. Risers used for the support of service wires are objectionable and should be used only in such cases where their use cannot be avoided. A riser must be of clear, sound straight-grained fir or cypress or equally strong material to conform to the rules of the Department of Gas and Electricity of Chicago.

8. Where a one story building is located on the alley lot line, the service, if brought out on the alley side of the building, will not clear the telephone wires if the pole is located on the same side of the alley as the building and will not give the required 18 ft. clearance over the alley (see paragraph 12 (c) if the pole is located in the opposite side of the alley. For this reason, the Department of Gas and Electricity of Chicago will permit a variation from the standard rule requiring services brought to the alley side of the building. On such one story buildings, the service should be brought out on that part of the building farthest from the alley, but in no case must the service outlet be more than 15 feet from the alley line. The service outlet should be placed on the same side of the building as the pole so that the service drop will extend away from the building and not over it. Where a pole is located directly back of a building of the above type, the service outlet, if located away from the alley side of the building, will in some cases, eliminate the necessity of conduit being carried down the pole. The above modification of the rule of the Department of Gas and Electricity of Chicago only applies to one story buildings and will, in many cases, avoid the use of objectionable risers. In many cases, risers and the installing of wires down a pole may be avoided by connecting a rear building to the service drop installed for a front building. In such cases, the customer must install weatherproof wire between the rear building and the front building, but the final connection on the front building service will be made by the Company.

9. Service outlets must not be located on chimney or on fire parapet walls extending above a roof.

10. Service outlets must never be terminated within 1 foot of a down spout which is located on a porch post or porch support.

11. Where a service outlet is terminated on a post supporting a porch, galvanized steel straps or braces must be fastened in such a manner that the post will be firmly held to the joist. Each strap must be at least 1 in. x 12 in. and $\frac{1}{4}$ in. in thickness, and must be fastened to the post and joist by lag screws, 2 into the post and 2 into the joist, such lag screws to be $\frac{1}{4}$ in. x $2\frac{1}{2}$ in. Two straps must be used, one on each side of the post.

12. Where wiring is being installed in buildings under construction which are to have a stucco or stone-coat finish, a substantial form of support for the service bracket must be provided, this support to consist of a 2 in. x 8 in. x 24 in. piece of timber projecting beyond the finish of the building and securely fastened to the studing of frame buildings or by hooks through the wall of brick or tile structures.

Instead of a timber, galvanized eye bolts, having a minimum diameter of $\frac{3}{8}$ in., spaced 8 in. apart, may be used, the eye portion of the bolts to extend at least 2 in. beyond the surface of the building. When bolts are used for the support of a timber or the service, they must extend through, and be anchored on the inside surface of the wall, to a substantial metal plate, not less than

$\frac{3}{4}$ in. in thickness and having at least 4 square feet of bearing surface on the inside wall of the building.

The length of service mains to be brought outside of the service outlet and the method of fastening service wires to a building for No. 4/0 service connection and larger, and the method to be used for attachment of service connection for stucco or tile buildings.

13. Clearances.

(a) The service wires must, in no case, be within easy reach from porches, windows, or any other part of the building ordinarily accessible to the occupants.

(b) The service outlet must be so located that there will be at least 24 inches' clearance between it and any telephone or signal wires where attached to the building, and at least 36 inches' clearance must be provided between the service drops of both systems in the open span, in accordance with the rules of the Department of Gas and Electricity of Chicago.

(c) When the Company's pole line is on the opposite side of the street or alley from that of the building to which service is to be given, the service outlet for such a building must be of sufficient height to give at least an 18 ft. clearance between any point of the street or alley and the service drop.

Underground.

1. Where the space beneath the sidewalk is excavated, the service cables will be terminated at a point about 3 feet inside the curb wall. Service mains installed by the customer must be brought to the nearest service entrance, if there be one within 50 feet of his premises.

2. Where there is no service available, application should be made to the Contract Department of the Company to have service installed.

3. Where there is no sidewalk excavation and where there is a basement at the property line, the service cables will be terminated at a point about 3 feet inside the basement wall.

4. Where no basement is available at the property line, the service will be extended underground, at the customer's expense, from the property line to any point designated, but in no case will the service be terminated in any place which is likely to be used for coal storage.

5. In case the customer does not wish to bear the expense of an underground service across his property, the underground service will be brought up on a pole at the lot line, provided the Company's underground mains are available in the rear of the customer's premises. The poles and the overhead service to the building will be installed at the customer's expense, unless the customer will permit the Company to use the pole to supply other customers.

6. On account of obstacles that are frequently met with in the street, it is impossible for the Company to determine in advance the exact location at which the service cables will enter the building. Because of this uncertainty, the service-switch cabinet should not be installed until after the Company has completed the laying of the service duct or pipe into the building.

7. Where the service cables are to supply not more than one set of building mains, the service-switch cabinet must be installed by the customer and located at the service stub in such a manner that the cables will be entirely enclosed. If this is not practicable, a junction-cabinet not less than 15 inches in length, 12 inches in width, and 6 inches in depth for No. 6 cable must be installed by the customer over the underground pipe and enclosing the Company's service cables. This cabinet must be provided with a cover



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Philip B. Maher, Architect

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CHICAGO

fastened in place with screws. Conduit must be installed by the customer to connect the junction-cabinet with the service-switch cabinet. Where the Company's service mains are larger than No. 6, the dimensions of the junction-cabinet must be obtained from the Inspection Bureau.

8. Where the service cables installed by the Company are terminated in a junction-cabinet enclosing the service cables, the customer's service conduit should be terminated at the junction-cabinet and locked into it. A sufficient length of wire must be left to permit the Company to make the connection to the service cables, inside the junction-cabinet.

9. The service-switch cabinet must be of ample size to permit the safe handling of the service cables, and the switch-panel arranged in such a manner as to permit the removal of the service cables for repairs or replacement without removing the panel. The service-switch must be fitted with lugs for connection to the service cables.

10. Where the size of the installation requires more than one set of underground cables into the customer's premises, the customer must install, at his own expense, a fuse-extension service-switch on each set of cables. A name-plate holder must also be mounted on the panel at each service switch, in order to facilitate ready identification, in case of an emergency on any of the several services.

ENCLOSED TRANSFORMER INSTALLATIONS.

I. GENERAL.

1. The specifications refer to transformer installations made on customers' premises where such installations require enclosures. These enclosures are subject to variation in detail, as local conditions may make necessary. Sketches showing the requirements of the Company will be furnished for each installation.

2. The enclosure for each installation must be constructed in accordance with the rules of the Electrical Code of the Department of Gas and Electricity and of the Building Code of the Department of Buildings of the City of Chicago.

3. The enclosure complete with all necessary facilities must be furnished by and at the expense of the customer, and constructed in accordance with these rules and the sketches furnished by the Company.

4. The enclosures must preferably be located on the first floor of the building, adjacent to an outside wall, accessible to a driveway, and provided with an outside entrance. If the enclosure cannot be so located, a free passageway must be provided from the enclosed space to the outside of the building to facilitate the installation and removal of all equipment. The space must be free from pipes or other obstructions.

5. The enclosures must be accessible at all times to properly authorized employees of the Company and to them only.

6. The necessary conduits from the enclosures to the service point selected by the Company at the property line must be provided by and at the expense of the customer and installed under the supervision of the Company.

7. The Company will, at its own expense, install and connect within the enclosure, the necessary service equipment, such as transformers, oil switches, and auxiliary apparatus.

8. One set of cable connections and service equipment will be provided by the Company for any customer, except that at the customer's request, the Company will install additional points of supply and cables connecting thereto, provided, that the customer shall reimburse the Company for the extra cost of making more than one installation.

The service equipment at all points of supply in such cases shall be the property of the Company.

9. All conduit and cable on the customer's premises, used solely for additional points of supply, shall be installed at the expense of the customer and shall be his property.

10. The Company reserves the right to use these transformer installations to serve customers on other premises. In such cases a reasonable rental, agreed to by the electrical engineer of the Company, will be paid by the Company for the proportionate part of space occupied by equipment used to supply such other customers.

11. In the following rules, the enclosures will be referred to in connection with 4,000-volt installations as "TRANSFORMER VAULTS," and in connection with installations above 4,000 volts as "INDUSTRIAL SUBSTATIONS."

II. TRANSFORMER VAULTS.

Location.

1. If the vault cannot be located on the first floor, space on another floor will be accepted if provided with the proper facilities. Where so located, a permanent overhead supporting structure, capable of handling a load of approximately 6,000 pounds must be provided by the customer, for raising and lowering the transformers in a vertical position from the delivery level to the desired level. Unless access to this space is had from a floor at the same level, an approved platform at the door level must be provided.

Walls and Ceiling.

1. The enclosing walls must be constructed of concrete, not less than 6 inches in thickness, or of brick not less than 9 inches in thickness.

2. The ceiling must be waterproof and constructed of fire resisting materials, such as concrete, hollow tile, or equivalent.

Floor.

1. The floor must be constructed of concrete of sufficient thickness to carry the weight of the transformers and the weight of electrical equipment to be installed, both of which will be indicated on the sketches provided by the Company. The floor must be laid with a pitch of $\frac{1}{4}$ -inch per foot from the side walls to the drain.

Entrance.

1. A vault must be provided with an outside entrance for the installation and removal of equipment and an inside entrance for the use of the Company's men for operating and inspecting purposes. The entrance provided for handling equipment must have a clear headroom of at least 7 feet above the threshold and a minimum clear width of 4 feet, 6 inches.

2. A concrete threshold 6 inches high must be installed in all doorways. All doorways must be thoroughly closed by means of an approved tight-fitting, fireproof door. The door must be so hung as to swing outward from the entrance, and must be provided with a hasp suitable for a standard padlock, which latter will be provided by the Company.

3. Surface entrances to basement or side-walk vaults must be equipped with transformer manhole frames and covers, or hinged steel doors approved by the Company.

4. All passageways between the entrance and the vault must have the same clear headroom and width as specified for the entrance.

Headroom.

1. Clear unobstructed headroom of not less than 9 feet must be provided in the vault.

Drainage.

1. The floor of the vault must be provided with an adequate system of floor drainage to take care of a possible overflow of oil or water.

Ventilation.

1. Sufficient ventilation must be provided to maintain the transformers within their safe operating temperature range. All ventilating openings into the building not connected to chimneys or flues must be provided with automatic or manually-controlled dampers to prevent the emission of smoke or fire. The arrangement and size of ventilating openings will be shown on sketches provided by the Company.

2. If natural ventilation is inadequate, forced ventilation must be provided. Plans for forced ventilating equipment and methods of installation and control must be submitted to the Company for approval. Ventilating equipment must be of sufficient capacity to completely change the air every two minutes.

Floor Space.

1. The vault must have a floor space in proportion to the transformer capacity to be installed, the exact size in each case to be specified by the Company. A customer's drawings of the vault must be submitted in duplicate to the Company for approval.

2. The room must be rectangular in shape, not less than 11 feet in width and from 26 to 37 feet in length, depending upon the number of transformers to be installed.

Vault Equipment.

1. All electrical equipment required for switching, transforming, and protective purposes, including primary and secondary bus work in the vault, will be installed, maintained and operated by, and at the expense of, the Company.

2. The customer must extend all secondary service cables to points designated by the Company, inside the vault. Such cables must be of sufficient length to be connected to the secondary busses, and be equipped with necessary lugs ready for connection. The final connection of the service cables to the busses will be made by the Company.

Primary Cable.

1. The primary cable required on the customer's premises to connect the vault equipment to the Company's system will be installed by the Company at the expense of the customer.

Meter Wiring and Service Switch.

1. The customer must provide a suitable panel or space on the switchboard outside of the vault for the installation of the Company's meters; and provide thereon the wiring, test links, and terminals required for such meters. The customer's secondary service switch must be placed outside the vault.

Lighting.

1. The necessary conduit and outlet boxes for the vault lighting system must be installed by the customer as a part of the vault structure. The location of lighting outlets will be shown on sketches furnished by the Company.

III. INDUSTRIAL SUBSTATIONS.

General.

1. The installation is to be placed in two adjacent fireproof rooms provided by the customer and must follow the specifications herein set forth and such supplemental specifications as the Company, may, in special cases, provide. One of these rooms containing the line and transformer primary switches, bus bars, and all 12,000-volt equipment will be known as the "Switch Room." The other containing the transformers and auxiliary control and protective equipment will be known as the "Transformer Room."

2. These rooms must at all times be readily accessible for inspection and repairs and where located above the ground floor a permanent overhead supporting structure, capable of handling a load of approximately 24,000 pounds, must be provided for hoisting the transformers to the required level. Unless access to such rooms is had from a floor at the same level, an approval platform at the room level must be provided, together with a stairway to reach same from the floor below or from the ground, so arranged as to give convenient access to the rooms at all times.

Meter Panel.

1. The customer must provide a suitable panel or space on a switchboard outside of the Switch and Transformer Rooms for the installation of the Company's meters and must also provide thereon the wiring, test links, and terminals required for such meters.

Ownership.

1. All building work in connection with the Switch and Transformer Rooms, including the concrete switch and bus structure in the Switch Room, and the necessary conduit in walls and floors, must be installed by and at the expense of the customer and shall remain his property. Detail plans for the Switch and Transformer Rooms, including the concrete structure, will be furnished by the Company.

2. All electrical equipment required for switching, transforming, and protective purposes, including primary and secondary bus work, in the Switch Room and Transformer Room, will be installed, maintained, and operated by and at the expense of the Company, with the exception that where the physical location of a customer's service entrance is not adjacent to the Company's secondary busses, the customer will reimburse the Company for the additional expense necessary to reach this remote location, and further, that the customer will extend his lighting service cable to the metering current transformers at the lighting transformer, ready for the Company to connect to its secondaries.

3. In case of a loop service, the Company will furnish, install, and maintain at its expense all 12,000-volt cable.

Lighting.

1. Approximately 8 lighting outlets are required in each of these rooms. Lighting service is to be 115 volts A.C.

SWITCH ROOM

Structure.

1. The Switch Room must have a minimum floor area of approximately 325 square feet, (preferable 13 x 25 feet) with a minimum head room of 12 feet. Standard fireproof doors must be provided to give access to, and emergency exits from, this room. In addition to the standard latches provided for these doors, they must also be equipped with bolts or locks. Where locks are required, standard cylinder locks will be furnished to the customer by the Company. All doorways must have a 6-inch threshold. Openings suitably located and equipped with adjustable louvres must be provided for the ventilation of this room.

Equipment in the Switch Room.

1. The electrical equipment in the Switch Room will consist of high-tension switches, disconnects, and other necessary auxiliaries to protect the customer's service.

TRANSFORMER ROOM

Structure.

1. The Transformer Room must have a floor space in proportion to the transformer capacity to be installed, (the exact size in each case to be specified by the Company,) and the headroom must be at least 12 feet.

An exterior fireproof door must be provided in this room, approximately 6 feet wide by 10 feet or more high, which will give ready access for the installation of the electrical apparatus. This doorway must have a 6-inch threshold and the door must be equipped with latches and bolts in addition to the standard cylinder lock furnished by the Company.

2. The floor of the Transformer Room must be provided with an adequate system of floor drainage to take care of a possible overflow of oil or water.

Equipment in the Transformer Room.

1. The electrical equipment in the Transformer Room will consist of the necessary power and lighting transformers, relay and control equipment, and high-voltage connections between the Switch Room terminals and the primary terminals of the transformers; also on the secondary side of the transformers all necessary copper bus and supporting framework between the secondary terminals of the transformers and the metering current transformers, which will be located as near as possible to the main transformer terminals.

Ventilation.

1. The customer must provide for air supply and exhaust in sufficient amount to insure proper cooling of the transformers. Where the temperature of the surrounding air is sufficiently low, properly located louvres of adequate size in the side walls, in addition to roof ventilators or their equivalent in exhaust duct to outside air, may be sufficient. Where the location renders this method of cooling inadequate, forced ventilation must be provided by the customer and should be so arranged that the supply will be adequate at all times. The Company will inform the Customer regarding the details of the ventilating provisions in each case. The system of ventilation must provide for a complete change of air in the Transformer Room every two minutes, assuring proper cooling of the maximum transformer capacity, which may be installed in the particular Transformer Room. Plans for forced ventilating equipment and methods of installation and control must be submitted to the Company for approval. If adequate ventilation is not available, or if the customer's load conditions require the installation of water-cooled transformers, the customer must provide suitable water supply and waste connections for this method of cooling, the details for which will be furnished by the Company.

WIRING.

Meter Connections.

1. Wiring must be so arranged that a separate meter may be installed for each class of service supplied under the Company's schedule of rates, as follows:

I Rate A.

1. Available for any customer using the Company's standard service for lighting purposes or for both lighting and power purposes, provided that electricity will not be furnished hereunder for welding machines, wireless telegraph apparatus, or other power apparatus in which the use of electricity is intermittent or subject to violent fluctuation and the operation of which may interfere with lighting service.

2. Where the rated capacity of the customer's installation is $1\frac{1}{2}$ K. W. or less, the maximum demand is determined in accordance with a table set forth in the rate schedule, which provides for different values of demand for commercial and for residence lighting. The arrangement of meter connections of such installations must be in accordance with the following regulations:

(a) The wiring of residence and commercial installations must be arranged for separate watt-hour meters.

(b) The lighting of halls, entrances, and basements of apartment buildings will be considered as commercial lighting provided that where the hall, entrance, and basement lighting installation has a rated capacity of 200 watts or less and where the owner occupies one of the apartments in the building as his place of residence, this lighting load may be connected to the meter for his apartment, and, if so connected, such an installation will be considered as residence lighting during the period of such occupancy.

(c) Where apartments and stores or shops are in the same building the apartment lighting will be considered as residence lighting and the store or shop lighting will be considered as commercial lighting, and the wiring should accordingly be arranged for separate meters, provided, however, that if the customer desires, both installations may be combined on one meter, and the combined installation will be considered as commercial lighting. (For combined installations exceeding $1\frac{1}{2}$ K. W. see 3-(b) below.)

(d) Where a portion of a store or shop is used as living quarters, and the wiring is arranged for a single meter for both the store or shop and the living quarters, the installation will be considered as commercial lighting.

3. (a) Where the rated capacity of a customer's installation is more than $1\frac{1}{2}$ K. W., the wiring must be arranged for the installation of demand meters.

(b) In case the residence and commercial lighting installations of a customer have an aggregate rated capacity of over $1\frac{1}{2}$ K. W. and are in the same building, both installations should be arranged for connection to one watt-hour meter, with demand-meters.

II Rate B.

1. Power service is supplied under this rate, and is defined as "electric service used for other purposes than lighting." Service for photographic printing, bath cabinets, and other kinds of equipment which are not used for general illumination, will be considered as power service and may be served under Rate B, if desired.

2. In the case of direct current installations, having rated capacity of more than $1\frac{1}{2}$ K. W., the maximum demand is measured, and provisions must be made for setting a demand-meter.

3. In the case of alternating current installations having a rated capacity of 10 H. P. or more, provisions must likewise be made for setting a demand-meter.

III Rate C.

1. The lighting and power service for large users may be combined under Rate C. However, on the alternating current system a separate service and meter may, at the option of the Company, be provided for the lighting service, and in such cases the wiring must be arranged accordingly for meters.

Residence and Apartment Loads.

1. Every residence and apartment lighting installation which does not exceed 3,000 watts, or 48 sockets must have a 2-wire service main and 2-wire meter loops, as such an installation will be connected to the Company's system by two service wires at 115 volts. Where the installation exceeds 3,000 watts, or 48 sockets, it must be wired for 3-wire service and a 3-wire meter. All wall receptacles other than brackets will be figured at not less than 100 watts each.

Commercial Loads.

1. Every business lighting installation of over 1500 watts must have a 3-wire service main and 3-wire meter loops except where the installation consists of 1-2000 watt circuit only. This must obviously be connected 2-wire. If the installation is 1500 watts or less, it must be wired with a 2-wire service

main and 2-wire meter loops. Motors operating on 115 volts and heating appliances on the lighting service will not be considered in determining 2-wire and 3-wire installations where the rated capacity of such equipment does not exceed 25% of the lighting load.

Business and Residence Loads in Same Building.

1. On installations where there are stores and apartments in the same building, the rule governing the service and meter installation is as follows:

Where the total connected wattage is 3000 watts or less, add to the total connected wattage of the stores $\frac{1}{4}$ of the connected wattage of the apartments, and, if the total is 1500 watts or less, the service mains and meter loops must be 2-wire. If this wattage, however, is in excess of 1500 watts, service mains must be 3-wire but the meter loops will be governed according to the rules above on residence and commercial lighting. Where the total connected load is in excess of 3000 watts, the service must be 3-wire.

Motor Loads.

1. In direct current territory where the aggregate power load does not exceed 10 H. P., the motor should usually be wired to connect to the lighting meter.

2. In alternating current territory, the fluctuation in voltage caused by the starting currents prevents the connecting of motors larger than $\frac{1}{2}$ H. P. of the split-phase type, or larger than 1 H. P. of the repulsion-induction type, to the lighting service, except in special cases. Two or more motors, not larger than the above mentioned sizes, may be connected to the lighting service where the aggregate does not exceed 2 H. P.

Miscellaneous Loads.

1. Single D. C. stereopticons, outlets for battery charging, and other devices which are operated most economically at 115 volts will be approved for this voltage. Where there is an installation of more than one such device in the same premises, they must, if the total wattage of the installation exceeds 1500, be connected to a 3-wire main and be balanced as nearly as possible.

2. Every alternating current vehicle-charging mercury arc rectifier in a private garage must be connected to the customer's lighting service, provided such a service is already installed. If the existing lighting service is a 2-wire service, a 3-wire outlet must be provided.

3. If, at the time the rectifier is installed, there be no existing lighting installation in the premises, and later the customer desires to put in a lighting installation, such an installation must be wired for a 3-wire service.

4. All rectifiers requiring an input of more than 2 K. W. must be operated at 230 volts.

5. In theaters, all alternating current or single phase motors, and such motion picture and spot arcs as are not supplied through 3 phase converting apparatus, must be connected to the same meter.

6. Alternating current arcs requiring more than 2 K. W. must be operated at 230 volts.

7. Where transformers are used in connection with motion pictures arcs or spot arcs they must be operated at 230 volts.

8. In the case of welding machines, X-ray machines, hoists, elevator motors, furnaces, and other installations of similar character, where the use of electricity is intermittent or subject to violent fluctuation, the Company reserves the right to require the customer to provide, at his own expense, suitable wiring or equipment to limit, in a reasonable degree, such intermittence, or fluctuation, where in the Company's judgment, such ap-

paratus is necessary to prevent undue interference with the Company's service.

Auto Transformers.

1. Where the lighting is connected to the power service by the use of an auto-transformer, as under Rate "C," such transformer must be provided at the expense of the customer. The auto-transformer must be connected between the two mains having the least difference of potential to the earth. Where the load is 20 K. W. or less, the capacity if the auto-transformer should be not less than 25% of the connected load in watts.

Voltage Regulation.

1. The wiring installed in the customer's premises should be of such capacity that the entire connected load can be carried with a loss in voltage of not more than 2% between the service entrance and the most remote lamp on the premises.

Switchboards.

1. Specifications and blue prints for service and meter-switchboard installations must be submitted to the Distribution Division of the Company for approval before construction of the switchboard is begun.

2. Fuses must be so arranged that they will be readily accessible for the purpose of replacement, and to this end, it is recommended that no more than three rows of switches be placed on a switchboard.

3. To prevent overheating of switches, fuses, and cables, it is recommended that all the lugs have a conductivity of not less than 60% of that pure copper and that their cross-sectional area be such that they will not be required to carry continuously more than 600 amperes per square inch. They should have a bolting contact surface of not less than 1 square inch for each 150 amperes of current.

4. The general arrangement of the connections on the back of the board must be such as to render it possible to make repairs or alterations with a reasonable degree of facility and safety while the board is in service.

5. The bus bars must be rigidly supported and the arrangement of the feeder cables between the terminal of the conduit system and the back of the switchboard must be made in a systematic and orderly manner and the cables must be segregated as far as possible, with a view to minimizing the possibility of serious interruption to the service.

6. Where the Company's service cables are extended inside of the customer's premises to the switchboard and where such cables are not protected by duct or conduit they must be properly roped and cemented at the expense of the customer.

Cutouts.

1. Fuse-blocks and service-switches must be equipped with fuses of approved type and capacity at the time of their installation.

2. The neutral wire of a 3-wire service-switch or cutout block for branch mains, except for 3-phase, must not be fused.

3. The neutral wire must be connected to the center blade of all 3-pole switches except for 3-phase. On 3-phase installations the two phases having the least difference of potential to earth must be connected to the two outer blades of the service-switch.

4. Switches and fuse blocks must not be installed above or in close proximity to laundry tubs, sinks, or other plumbing fixtures.

Grounding Conduit on Neutral Service Wire.

1. The use of the neutral service wire for grounding conduit is not permitted. The conduit should preferably be grounded to the cold water piping system, in accordance with the rules of the Department of Gas & Electricity of Chicago.

2. The customer must ground the neutral wire of his installation separately from the ground provided for the conduit system. This neutral ground must be installed according to the rules of the Department of Gas and Electricity of the City of Chicago. 3-phase and 2-wire, 230 volt single phase systems having no wires within the building at ground potential, are not to be grounded at the building service.

AUXILIARY OR BREAKDOWN SERVICE

1. Where a customer contracts to use the Company's service as an auxiliary or breakdown service in connection with his usual source of supply, he must, in case the number of kilowatts which the Company is obliged to stand ready to supply under the contract be less than the estimated maximum of the customer's plant, as estimated by the Company, furnish and install a circuit breaker of a type approved by the Company. This circuit breaker shall be set to break the connection with the Company's service in case his maximum demand shall at any time materially exceed the number of kilowatts which the Company has agreed to supply.

2. The circuit breaker must be installed by the customer at a suitable location between the Company's meter and the customer's load, and must be in a steel cabinet so constructed that it can be sealed by the Company.

ADDITIONS AND ALTERATIONS

1. When any change in the size of a customer's installation is made, the Company must be informed, so that it may inspect the installation and provide service and meter of the proper capacity. If alterations are to be made in a building, which may disturb the electric wiring and require the re-location or removal of the Company's meter, the Company must be notified in advance, in order that the changes may be given proper attention. If it is necessary to move the meter to a new location, this change will be made if meter fittings are provided. A temporary location and meter fittings must be provided by the customer, if electricity is desired during such alterations, but under no circumstances will the use of electricity be allowed without a meter.

APPARATUS.

Welders and Furnaces.

Call Commonwealth Edison Co., Randolph 1280 for information.

X-Ray Machines.

Call Commonwealth Edison Co., Randolph 1280 for information.

RADIO TELEPHONE AND TELEGRAPH EQUIPMENT

1. All radio telephone, and telegraph apparatus, employing set-up transformers which require an input of more than 250 watts and all spark sets must be wired for a separate service connection.

2. All such step-up transformers of any capacity must be protected by an approved spark gap.

3. No ground will be permitted on spark equipment, except on the secondary side of the oscillation transformer. Such a ground must be connected to the cold water piping at a point nearest the street mains.

4. All high tension or high frequency wiring used in connection with the apparatus must be located as remotely as possible from the meter and wiring of the building.

5. Motor generator sets supplying radio telephone and telegraph apparatus shall be subject to the rules applying to motors.

6. Where a radio telephone or telegraph set requires more than 2 K. W. the coils must be operated at 230 volts.

Electric Ranges, Ovens, and Heating Appliances.

1. Electric ranges and other heating appliances in which the aggregate rating of

the heating units is not more than 2 K.W., will be connected for 115 volt, 2-wire service. Where the aggregate rating of the heating units exceeds 2 K.W., they must be so arranged that they may be connected to a 3-wire, 115-230 volt circuit, and the units must be balanced as nearly as possible on each side of the circuit.

2. Electric ranges and heating appliances for family use must be connected to the lighting service, if one is installed.

3. Electric ranges, ovens, and heating appliances of 10 K.W. and less, installed in places of business, must be connected to the lighting service, if the customer has a lighting service only. If, however, there is both, a lighting and a single-phase power service, or a single-phase power service only, such apparatus should be connected to the power service. Where the K.W. rating is in excess of 10 K.W., or where the heating load is intermittent, inquiry should be made of the Distribution Division of the Company, as to how the particular installation should be connected.

Nameplates.

1. All electrical equipment such as motors, welders, furnaces, X-Ray and radio apparatus, heating utensils, and the like, must be provided with nameplates showing the rating of the apparatus. This rating must be in kilowatts, horsepower, kilo-volt amperes, or amperes and volts, cycles, phase; according to the nature of the apparatus. The character of current required for the operation of such apparatus must also be designated.

MOTORS.

General.

1. The following motor regulations are necessary for the purpose of securing uniform service for all customers, as the successful operation of motors on the same circuits with lighting apparatus requires that the normal voltage of the supply circuit be closely maintained.

2. In the case of hoist or elevator motors, welding machines, furnaces, and other installations of similar character, where the use of electricity is intermittent or subject to violent fluctuation, the Company reserves the right to require the customer to provide, at his own expense, suitable wiring or equipment to limit, in a reasonable degree, such intermittence or fluctuation, where in the Company's judgment, such wiring or equipment is necessary to prevent undue interference with the Company's service.

3. Stationary vacuum-cleaner motors of over 1 H.P. which are used in apartment buildings, must be so wired that separate meters for them can be installed. This rule prohibits the connection of these motors to the individual tenants' meters.

Direct Current.

1. Direct current motors of $1\frac{1}{2}$ H.P. and smaller may be operated on either 115 or 230 volts. Motors larger than $1\frac{1}{2}$ H.P. must be operated on 230 volts.

2. A starting resistance is recommended in connection with all direct current motors, but motors not larger than $\frac{1}{2}$ H.P. of the shunt type, $\frac{3}{4}$ H.P. compound, and 2 H.P. series wound, not requiring a starting current in excess of the values given in the starting current tables, may be installed without starting resistance.

3. Direct current motors aggregating 10 H.P. or less must usually be wired so that they may be connected to the lighting meter.

Alternating Current.

1. Motors of less than $\frac{1}{2}$ H.P. may be operated on either 115 or 230 volts on the lighting service and meter and the starting

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current under any operating condition, must not exceed 15 amperes when measured with a well damped ammeter.

2. Motors of 1/2 H.P. in size may be operated on either 115 or 230 volts, on the lighting service and meter and the starting current under any operating condition must not exceed 20 amperes when measured with a well damped ammeter.

3. Motors of 3/4 and 1 H.P. in size must be operated on 230 volts on the lighting service and meter, and the starting current under any operating condition must not exceed 20 amperes when measured with a well damped ammeter.

4. Motors of over 1 H.P. in size must be operated on 230 volts on a separated service and meter.

5. When the aggregate rating of 2 or more motors of which the largest motor does not exceed 1 H.P. amounts to 2 H.P. or less, they must be wired on the lighting service and meter.

6. When the aggregate rating of 2 or more motors exceeds a total of 2 H.P., they must be wired on a separate service and meter.

I. Single Phase System.

1. When single phase motors or other apparatus are connected to one phase of a 3-phase installation, they must be connected between the two wires having the least difference of potential to the earth. When the service is not alive for test the single phase motor must be connected to the outside blade of the 3 pole service switch. The Distribution Division of the Company must be notified when any single phase motor is to be connected on a 3-phase installation.

2. No motors larger than 5 H.P. will be supplied on the single phase system except by special permission given in each case by the Distribution Division of the Company.

II. Three-Phase System.

1. Motors of 5 H.P. or more are supplied from the 3-phase system in a large part of the alternating current territory, but inquiry should be made of the Contract Department of the Company as to the proximity of 3-phase lines to any particular location at which such power may be desired.

2. 3-phase service will not be provided for installations aggregating less than 5 H.P. unless the customer deposits with the Company a sum equivalent to the excess cost to the Company of installing a 3-phase service and meter, above the cost of installing a 3-phase service and meter, plus the excess cost of installing a 3-phase line extension over a single phase extension, provided such an extension is required, and provided further that such service is furnished for any installation aggregating less than 2 H.P. of 3 phase motors. In case the customer's power installation shall subsequently be increased to a total rated capacity of 5 H.P. or more, the Company will return the amount of the deposit, provided the additional motors installed are 3-phase.

3. Reverse-phase relays or series-wired hatch-limit switches must be installed on all 3-phase elevator, crane, and similar installations, as required by the Department of Gas and Electricity of Chicago.

1. On all new installations of motors and other power equipment, aggregating 100 H.P. or over, the power factor of the total power installation must be at least 85% at normal full load.

2. Whenever any motor or other power equipment is added to the power installation of any present connected customer, increasing the aggregate horsepower of his power

load to 100 H. P. or over, the power factor of the total power installation must be at least 85% at normal full load.

3. The Company reserves the right to test, at any time, all motors and other power equipment on the customer's premises, for starting current, efficiency, power factor, or other characteristics which may affect the Company's service.

4. The Company reserves in the case of any customer, the right to place special limitations other than those specified in the section entitled "Starting Current," on starting and pulsating currents of motors and other power equipment, where, in the Company's judgment, such limitations are necessary to prevent objectionable disturbance on its lines. In any event, the pulsating current of any large motor must not exceed 66% of the rated full load current of the motor.

5. On any installation requiring motors of 40 H.P. and larger, a synchronous type motor is recommended, when practical, because this type of motor has power factor corrective characteristics, which will materially aid in raising the customer's over all power factor.

Starting Equipment.

1. All motors of 7 1/2 H. P. rating, and above, must be equipped with starting apparatus.

2. Every starting device must be equipped with a no-voltage release which will cause it to be thrown to the starting position, or the circuit opened entirely, in case of an interruption to the power supply. Motors which are equipped with an internal resistance, making it unnecessary to install a compensator in order to reduce the starting current, must be equipped with a no-voltage release device unless the internal resistance is automatically cut in by the reduction of the motor speed when the power circuit is opened. For motors of large capacity which are difficult to start, the no-voltage release must have a time element relay, which will prevent the opening of the circuit in the event of momentary voltage fluctuation.

3. Special permission will be given for the connection of special high-resistance-rotor elevator motors not larger than 10 H.P. without the use of a starting device, provided, the starting current does not exceed the values given in the table for starting currents.

Starting Current.

1. As voltage regulation is affected by the amount of current taken from the line, a motor exceeding the maximum allowable starting current will not be connected to the lines of this Company, since its operation would prevent satisfactory service to other customers using the lighting service of the Company. The instantaneous current (determined by test or based on the value guaranteed by the manufacturers) drawn from the lines by any motor (with the starting device, if any required, in the starting position) must not exceed the value for the rated horsepower of such motor, as obtained from the following tables:

2. SINGLE-PHASE—60-CYCLE

Horsepower	Volts	Starting Amperes	
		A*	B**
1/2 H. P. and below.....	110	15	20
1/2 H. P.....	110	20	26.5
3/4 H. P.....	220	15	20
1 H. P.....	220	20	27
1 1/2 H. P.....	220	22.5	30
2 H. P.....	220	30	40
3 H. P.....	220	45	60
5 H. P.....	220	75	100

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Six different loads are carried continuously and it is essential that there be no interruption in any one of these services.

- 1—the cooling and conditioning of 85,000 cubic feet of air per minute.
- 2—the freezing of 25 tons of ice daily.
- 3—the cooling of the circulating drinking water for the 3000 rooms.
- 4—the cooling of 70 refrigerators.
- 5—the cooling of storage rooms.
- 6—the freezing of 120 quarts of ice cream every hour.

The confidence which the Stevens has in Carbondale equipment is based on past performance. Carbondale Refrigeration has proven its merit during more than 35 years of service to every business and industry that uses refrigeration.

Our engineering department will gladly co-operate in the economical application of refrigeration for your particular needs. You incur no obligation by availing yourself of this service.

THE CARBONDALE MACHINE CO. CARBONDALE, PA.

Chicago Office: 325 W. Huron St.
Phone Superior 2055

Branches in principal cities

THREE-PHASE—60-CYCLE

Horsepower	Volts	Starting Amperes	
		A*	B**
1 H. P.	220	20	26.6
1½ H. P.	220	27.5	36.6
2 H. P.	220	35	46.6
3 H. P.	220	45	60
5 H. P.	220	65	86.6
7½ H. P.	220	86	115
10 H. P.	220	106	141
15 H. P.	220	148	197
20 H. P.	220	188	251
25 H. P.	220	228	304
30 H. P.	220	270	360
35 H. P.	220	277	370
40 H. P.	220	285	380
50 H. P.	220	300	400
Amperes per H. P.—			
60 H. P. and above,	220	6	8

* Current values under A are those indicated by a suitable, well-damped ammeter in the motor circuit on the line side of the starting device for the installation of a single motor installed and connected to its load.

** Current values under B are those similarly indicated when testing a motor with the rotor locked.

3. DIRECT CURRENT

Shunt and Compound Wound

Horsepower	Volts	Starting Amperes Motor connected to Rated load	
1 H. P. and below	220	12	
1½ H. P.	220	18	
2 H. P.	220	24	
3 H. P.	220	36	
5 H. P.	220	45	
7½ H. P.	220	68	
10 H. P.	220	90	
15 H. P.	220	135	
20 H. P.	220	180	
25 H. P.	220	228	
30 H. P.	220	270	
35 H. P.	220	315	
40 H. P.	220	360	
50 H. P.	220	450	
Amperes per H. P.—			
60 H. P. and above,	220	9	

Motor Table.

Size	Operating Voltage	Maximum Starting Current	How Wired
Less than ½ H. P.	115 or 230v	15 amp.	On lighting service and meter
½ H. P.	115 or 230v	20 amp.	On lighting service and meter
¾ H. P.	230v	15 Amp.	On lighting service and meter
1 H. P.	230v	20 Amp.	On lighting service and meter
Several motors aggregating 2 H. P. or less with no motor larger than 1 H. P..	115-230v 3 W		On lighting service and meter
Over 1 H. P.	230v		Separate service and meter
Several motors aggregating over 2 H. P..	230v 2w or 115-230v 3w		Separate service and meter

Fire Pumps.

1. Fire-pump motor installations must be made in accordance with the rules of the authorities having jurisdiction over such installations.

2. Meters for fire-pump installations shall be of the shunt type for direct current system and of the current transformer type for alternating current systems. A meter-cabinet of shape and dimensions as shown on the drawings, on pages 60 and 61, must be furnished and installed by the electrical contractor. This cabinet must be provided with a door which can be fastened with a padlock, which will be furnished by the Company. The cabinet may be located at any point in the service run, provided it is readily accessible and not subject to moisture or vibration. Conduits carrying service mains must enter the cabinet in a standard manner, and the cables must be long enough to connect with lugs on the shunts or current-transformers. The lugs for the shunts or current-transformers will be furnished by the Company, but are to be installed by the customer at his expense. A 1 in. slate base for the mounting of the meter and other equipment, standard cartridge-fuse cutout-block of capacity shown, must be furnished and installed by the customer at his expense.

3. Where a separate service is required for a fire pump, the customer must pay the cost of the service installation. Where a meter has been furnished by the Company for regular power load, the usual rental will be charged for the separate fire-pump meter, as provided under "Meters," sub-title "General," paragraph 2, page 43. In case a printing meter is required the usual rental will be charged and the customer must pay for installation of such meter.

MOTOR TABLE

Showing voltage and wiring instructions for single phase motors for both intermittent and non-intermittent classes of service.

Size	Class of Service	Voltage	Repulsion-Induction Motors	Split-Phase Motors	
			How Wired	Voltage	How Wired
1/8 h.p. Intermit.	115		To light meter	230	To light meter
1/4 h.p. Intermit.	115		To light meter	230	To light meter
1/2 h.p. Intermit.	115		To light meter	230	To light meter
3/4 h.p. Intermit.	230		To light meter	230	Separate service
1 h.p. Intermit.	230		To light meter	230	Separate service
1 1/4 h.p. Intermit.	230		Separate service	230	Separate service
1/8 h.p. Non-Inter.	115		To light meter	115	To light meter
1/4 h.p. Non-Inter.	115		To light meter	115	To light meter
1/2 h.p. Non-Inter.	115		To light meter	230	To light meter
3/4 h.p. Non-Inter.	230		To light meter	230	Separate service
1 h.p. Non-Inter.	230		To light meter	230	Separate service
1 1/4 h.p. Non-Inter.	230		Separate service	230	Separate service

METERS.

General.

1. The Company will install one meter or one unified set of meters for one class of service.

2. A monthly rental charge for each additional watt hour or demand meter is made by the Company when, at the request of the customer, and for his convenience, there is an installation of more than one meter on his premises for one class of service. This rental is based on the size of the meter installed.

3. The Company must be consulted whenever it is necessary to know in advance the type and size of meter which a given installation will require. Information relative to the type of watthour meters and maximum demand meters to be used on large installations must be obtained from the Distribution Division of the Company before wiring is completed.

Location.

1. All meters must be installed in a suitable place as near as practicable to the point at which the service enters the building. The wires should be enclosed in a continuous metal conduit, containing no junction or outlet-boxes between the service entrance and

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1. KEEPS TENANTS SATISFIED
2. SAVES EXPENSE



Architects and Building Managers take their punishment when an improper selection of mechanical refrigeration is made. It is small wonder some are skeptical.

To a skeptical clientele we do not hesitate to say, COPELAND has proven its SUPERIORITY by every known test.

Proof lies in the fact that we have been compelled to increase our manufacturing facilities four times within the last five years: COPELAND enjoyed the LARGEST NATIONAL INCREASE among major refrigeration companies during the first six months of 1930.

We carry a complete line of models adaptable to apartment house, home and commercial use.

COPELAND REFRIGERATION COMPANY

of Chicago

160 East Illinois Street

Direct Factory Branch
COPELAND SALES COMPANY
Mount Clemens, Michigan

For information—Phone Whitehall 5600

the meter. The installation of load-wires in the same conduit is not allowable. In office buildings, special meter-closets of ample size must be provided on each floor; in apartment buildings, all meters should preferably be installed in the basement, and the circuit to each apartment should be carefully labeled. In residences, meters should be installed in the basement, or in a rear hall, and not in the attic.

2. The requirements of a "suitable place" for a meter are the following:

(a) Meters must be accessible to the Company's employees at all reasonable times, and must be so located that they may be easily read, inspected, and tested, with a minimum of annoyance to the tenants. Small capacity meters must be so installed that the top of the meter fitting is not more than six feet from the floor, and on meters of a capacity of 100 amperes and above, this distance must be not more than 4 feet 6 inches. Meters must not be placed in bedrooms, closets, bath or toilet rooms, or in any room commonly kept locked, in too close proximity to coal bins, in elevator or ventilator shafts, near stoves, radiators, sinks, wash tubs, steam piping, heaters, or boilers. Meters must be at least 3 feet from any gas meters or gas piping unless a suitable barrier is provided. Where meters are to be installed in a narrow passageway or in a narrow space such as back tanks, switch-boards or machines, the spacing in front of the meter board must be as follows: For 30 and 60 ampere meter-fittings, 3 feet and for 100 ampere fittings and above, greater space, the amount to be determined by the Inspection Bureau of the Company, depending on the character of the installation. Meters placed behind boilers or heating tanks which are not insulated to prevent radiation of heat, or behind machines in motion, must be more than 3 feet from such equipment, and in such cases the amount of space is to be determined by consultation with the Inspection Bureau of the Company.

(b) The location selected must be free from moisture. A watt-hour meter must never be placed under a water pipe from which water may drip, as a result of condensation. When a damp location is unavoidable, a moisture proof cabinet must be provided by the customer to contain the meter.

(c) The location must be free from vibration. Where traffic is heavy, or cars are passing, meters should be placed upon a wall at the building-line, rather than upon the front curb wall, and must never be placed under the sidewalk, except by special permission from the Distribution Division of the Company. They must not be placed on any insecure partition, over a doorway, or in a stairway.

(d) Meters must be located, if possible, so that they will not be exposed to mechanical injury. If this is unavoidable, a suitable cabinet must be provided by the customer to contain the meter, so as to protect it thoroughly from possible damage.

(e) The meter location must be as free as possible from magnetic disturbance. Meters must not be installed in close proximity to motors or generators or cables carrying heavy loads. Cabinets for direct current meters must be of asbestos board or non-magnetic metal.

3. When meters are to be installed for construction work, substantial cabinets of weather-proof construction must be provided by the customer to protect them from injury. The final connections between the customer's wiring and the Company's mains will, in every instance, be made by the Company. When it is possible, a meter location which can be used throughout the construction period should be selected at the outset.

4. Meter-cabinets must be of ample size to permit the safe handling of wires for connecting, disconnecting, or testing the meters. If a metal cabinet is used, the inside must be lined with suitable insulating material.

5. Meter-fittings for private garages must be so located that the meter can be read without the necessity of entering the garage except in cases where the garage is open or where a key can be obtained on the premises at all reasonable hours. A meter can be read without entering the garage if installed so that it faces a window made in the wall of the garage. This window must be covered by glass so as to render the meter visible and in addition, protect it from damage and theft. When this method is used, the meter board must be hinged or otherwise installed so that the meter will be accessible for testing. Subject to the approval of the Company, other methods of installing the meter so that it may be read without entering the garage will be considered.

Meter Loops.

1. Meter loop fittings must be provided on all installation where the meter installed is of smaller capacity than 200 amperes. The size of a meter is determined by the amount of current required on any given installation and not by the connected load. Therefore, it is necessary to take this fact into consideration when determining whether or not a meter fitting is necessary.

2. When meter loops are provided for meters of smaller capacity than 200 amperes an approved meter safety cabinet and meter connection-block must be installed. Approved safety cabinets are of a type which permit the mounting the Company's watt hour meter in combination with the cabinet so that by means of suitable adapters or end walls, all connecting wires are completely enclosed. Approved connection-blocks are of a type which permits disconnecting the meter for exchange or test without interruption to the customer's service. All necessary adapters or shutters will be furnished by the Company and installed with the watt hour meter.

3. Safety-cabinets and meter connection-blocks, which can be used interchangeably to a large extent, have been standardized and they are now obtainable from a number of different manufactures. They comprise in the 30-ampere size.

(a) A combination fused service-switch and connection-block for single installations.

(b) A fused connection-block and cabinet for bank or single installation with separate service-switch.

Connection-blocks for installations of over 30 amperes are, as a rule, not available in combination with fuse blocks or service-switches.

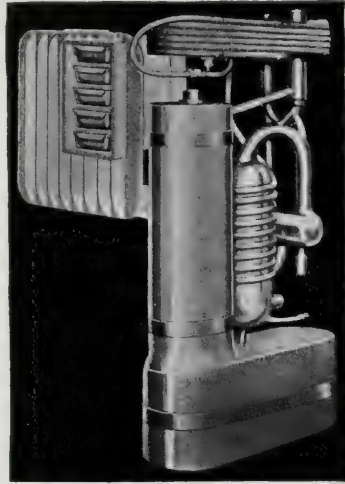
5. For the mutual protection of customer and Company, all service and meter-cabinets will be kept sealed in order to accomplish the full safety features of the equipment. Consequently, when they are of a fused type, circuit fuses must also be provided on the load side of the meter which will be accessible to the customer. The fuses in the meter cabinet should be of a size determined by the capacity of the connection-block and should in all cases be heavier than the customer's fuses.

6. A card-holder must be provided on every meter loop fitting. The contractor must insert in this holder a card showing the complete address and the location in the building of the premises connected to the meter fitting.

7. Meter-loops or meter-fittings must be so arranged that the meters can be placed at least 6 inches away from iron cabinets and cut-out boxes, conduits, ceilings or walls,

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so as to permit the safe handling of wires during tests. On installations requiring 200 amperes, meters or larger this clearance must be 12 inches.

7a. The minimum distance between a floor and the bottom of the lowest meter-fitting must not be less than 2 feet.

7b. On alternating current installations there must be 14 inches clearance, and on direct current installations 28 inches clearance, from the top of a meter-fitting to the bottom of the next one above or to the bottom of a cutout cabinet or any grounded surface. This distance must also be maintained between the top of a meter-fitting and a ceiling.

8. The distance between centers of meters of 50 amperes or less must not be less than 10 inches for A. C. and 15 inches for D. C. meters. Meters of a capacity in excess of 50 amperes must have a distance between centers of not less than 24 inches, and the leads of one meter must not run within 12 inches of another meter.

9. Service and house leads for type C. S. 2 and type C. S. 3 Thompson direct current meters, which are the types usually installed in size of 200 amperes and larger, must be carried in a metal trough to a point directly beneath the meter, and must be brought outside the trough through bushings spaced far enough apart so that the loops may be run in a direct vertical line to the meter terminals. They must be so anchored that the weight of the cables will not rest on the meter terminals. The length of the meter loop required outside the trough is determined by the type of meters to be installed.

10. When external resistances, current or potential transformers are used in connection with meters, they must be located where they are accessible for inspection and can be removed without danger of making a short circuit.

11. Contact-making clocks for operating type P demand meters must not be installed within a loop formed by the cable leads nor close to conductors carrying heavy currents, as the magnetic field may affect their accuracy, nor should they be installed in any place subject to extreme changes in temperatures.

12. For the following 2-wire installations one side of the line is to be brought to the meter with a potential or neutral tap from the other side.

2-wire 115 volt D. C. meters.

2-wire 115 volt A. C. meters.

2-wire 230 volt D. C. meters (115 volt neutral tap).

2-wire 230 volt A. C. meters larger than 150 amperes.

13. In case of 115 volt meters the potential tap must be from the neutral wire.

14. Both outside wires and a neutral tap must be carried to the meter for all 2-wire 230-volt A. C. meters of 150 amperes and smaller; also for all 3-wire, 230-volt meters. For D. C. meters a potential tap from the neutral wire must be provided. * * *

15. For 3-phase meters, the 2-phase wires from the outside blades of the service switch and a potential tap from the third phase or middle blade of the service switch, must be brought to the meter, and where current transformers are used in connection with the meter, three potential wires are required, one for each phase.

16. Three-phase meters for 460 volts potential are installed only with current-transformers, and must be mounted on a slate or asbestos board panel. In addition to the potential wires, one for each phase, a special one-half voltage tap must be brought to the

meter when it is necessary to operate a standard demand meter attachment. The service connection which is required for the one-half voltage tap must be arranged for with the Inspection Bureau of the Company before it is installed.

17. Potential taps for all meters must be so made that they cannot become disconnected. The connecting wire should be as short as possible, and must be run without a break and without a fuse between the house side of the service-switch and the meter-fitting. If the tap is broken in any place it must be soldered at point where the break connection is made.

Meter Fuse Protection.

1. All meters must be protected by suitable fuses of approved capacity. Meters must never be placed between the service and the service-switch.

Meter Board.

1. On installations where meter fittings are installed of less than 200 amperes capacity, a suitable meter-board of pine or other soft wood, not less than $\frac{3}{8}$ in. in thickness, or transite board (or equivalent), not less than $\frac{1}{2}$ in. in thickness, must be provided by the customer and fastened rigidly to the wall or other support. If transite board or equivalent is used it must be so mounted that it will be accessible from the back of the board in order to permit a nut to be fastened to the machine bolt which is used for support of the meter. Where the meter-board is mounted on metal lath or other metal structure, all supporting screws or bolts must be countersunk. The dimensions of meter-boards and the location on them of meter-fittings of less than 200 amperes capacity, may be secured from the Commonwealth Edison Co.

Types and Dimensions.

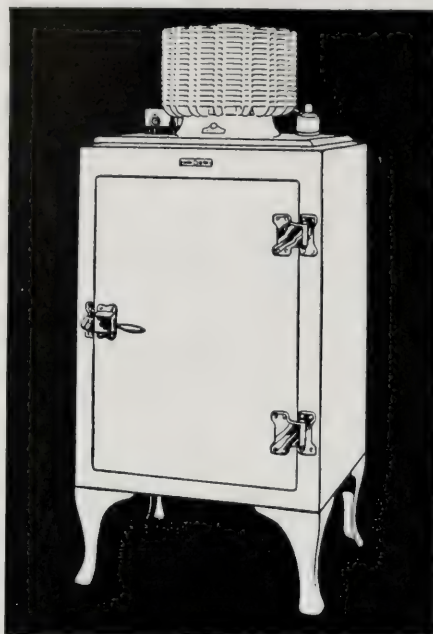
1. Standard front-connected meters are provided for all alternating current installations. Current-transformers are used in connection with alternating current meters of a capacity in excess of 150 amperes. Current and potential transformers are required on all motor installations on primary lines.

2. Standard front-connected type of direct current meters are used up to a capacity of 150 amperes, 230 volts, 3-wire and 300 amperes, 230 volts, 2-wire. Meters of larger capacity, of either the front-connected or the back-connected switchboard type will be furnished.

Switchboard Meters.

1. Switchboard meters and their necessary equipment will be furnished by the Company for large installations if the customer makes arrangements with the Company in advance and provides for the necessary drilling and connections for both meters and their equipment. Demand meters, printometers, contact-making clocks, and relay switches are part of the meter equipment. Proper templates and wiring diagrams will be furnished by the Company.

2. Test-links must be installed with all switchboard meters. For 2-wire meters, two test-links are required, one in the service lead to the meter, and one in the load lead from the meter. For the 3-wire meters, four test-links are required, one in each of the service leads to the meter, and one in each of the load leads from the meter. Test-links should be located on the front of the switchboard. The meter test-links approved may be secured from the Commonwealth Edison Co. The test-terminals, studs, and links of an approved type only will be accepted by the Company and must be furnished and installed by the customer.



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3. In all cases test-links must be readily accessible and must be placed at a distance of not less than 2 inches from any switches, bus-bars, switchboard-frame, or frame bolts, so as to eliminate, as far as possible, danger from short circuits in making connections for tests.

4. When current-transformers or other metering equipment are mounted at the rear of the switchboard, there must be left a clear space of not less than 30 inches between such current carrying parts and the wall, to permit free access to this equipment.

5. The fuses provided for protection of printometer and other demand meters must be mounted so as to be accessible without the danger of the Company's representatives coming in contact with live parts of the switchboard while replacing these fuses.

6. Various details, such as the method of metering, the type and capacity of watt hour meters and maximum demand meters, and the size of test-links, will be determined by the Company for each switchboard installation. These details must be taken up with the Distribution Division of the Company by the customer or his representative before the board is designed and sufficiently in advance of its construction to give the Company sufficient time to obtain the special equipment. Blue-prints or sketches showing the proposed location and connections of meters and equipment on switchboards must also be submitted to the Distribution Division for approval, before the switchboard is constructed.

TAMPERING WITH METERS OR CLOSING METER LOOPS

1. All meters are sealed by the Company. The breaking of meter seals by unauthorized persons, tampering with the meters or cut-outs, or tampering with any wires or switches in connection with the meter wiring or the unauthorized closing of meter loops will not be permitted by the Company. Attention is called to Revised Statutes of Illinois, Chapter 38, Section 117, in force July 1, 1895. The penalty for the breaking of this law is a fine or imprisonment, or both.

LAMPS

1. The Company furnishes, without charge, to customers using lighting service under the Company's regular lighting schedule, one standard 60 watt Mazda lamp for each socket of the customer's installation. Special types of lamps, or lamps of other wattages will be furnished at an extra charge. Information regarding such extra charges may be secured at the Company's main office or at any of its lamp exchange stations. All lamps furnished by the Company, on either a free or an exchange price basis, remain the property of the Company, and the customer must pay the Company the regular merchandise sale prices for all broken or unaccounted for lamps. The Company, however, will not reimburse the customer for any part of the exchange price which he may have paid for lamps returned, unless the lamps have not been used.

2. The customer may at any time exchange lamps which have been furnished by the Company for lamps of other wattages or types, upon payment (if required), of the exchange price of the lamps desired, but when the lamps requested are 100 watts or larger in exchange for lamps of less wattage, such lamps will be furnished subject to an inspection by the Company, based on the rules of the Department of Gas and Electricity of

Chicago with regard to the number of watts and lamps to be used on the circuits.

3. Lamps which are used for photographic printing, bath-cabinets, resistances, or any purpose other than illumination, are considered to be used for power purposes, and the installation and renewal of such lamps will not be made on the free or exchange basis.

4. Lamps which are used in places of extremely high temperatures or where they are subject to excessive vibration, or in places where the life of a lamp is materially reduced, will not be furnished on the free or exchange basis.

INSPECTION

1. All wiring which is to be connected with the Company's service must be inspected and approved by the Department of Gas and Electricity of the City of Chicago, and must conform to the rules and regulations established by the Company from time to time.

2. A temporary current-permit, or final certificate of inspection issued by the Department of Gas and Electricity of the City of Chicago must be presented at the office of the Company's Inspection Bureau before the electricity can be turned on. This applies to additional wiring which may be connected at any time, as well as to original installations. The Company reserves the right to make final connections of all wiring to its mains and, in case any damage results from unauthorized connections, the customer will be held responsible.

3. The Company furthermore reserves the right to discontinue service to the customer in case the Company deems the condition of the customer's wiring either hazardous or not in compliance with the Company's rules and regulations. The Company reserves the right to discontinue the customer's service on orders from the Department of Gas and Electricity of the City of Chicago when such a step is deemed necessary by that Department in order to secure compliance with the Electrical Code of Chicago.

4. Every electrical contractor is especially urged to stencil or provide a tag with his name, address and telephone number on the service or cutout-cabinet or meter-board.

This information will insure a closer cooperation between the Company and the contractor by enabling the Company to inform him quickly of any defects—with the result that the Company can render prompt and efficient service to both the contractor and the customer.

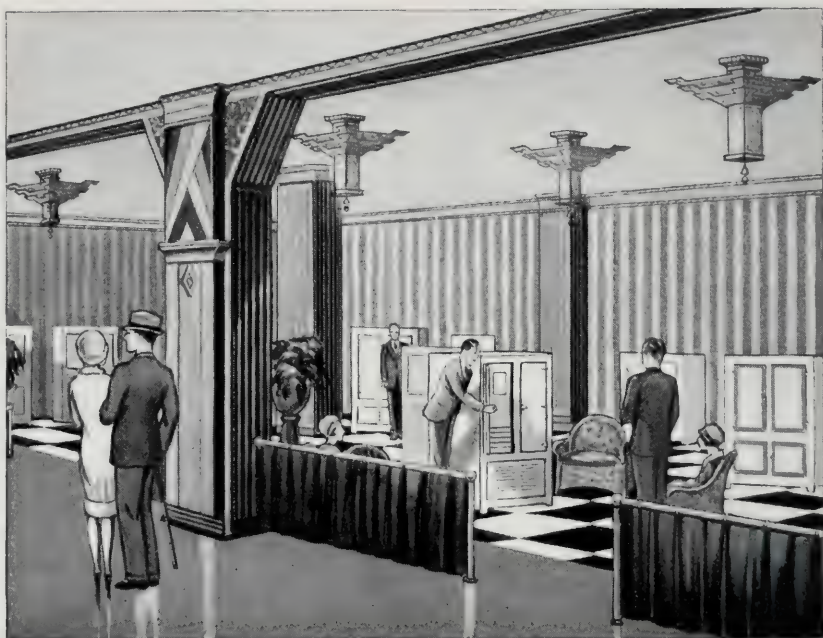
SPECIAL NOTICE

In view of the extension from time to time of alternating current lines into direct current territory, quite special attention should be paid to the manner in which cables on mains and sub-mains are installed in conduit.

In order to prevent prohibitive inductive effects, mains and sub-mains, conducting alternating current, should be placed in one conduit, when such mains or sub-mains comprise a circuit or a particular wiring system to any part of the building. This course should be pursued in case of direct current in order to obviate induction troubles when the change is made to alternating current at a later date.

It has been quite a common practice on installations where the larger size cables are involved to install them in separate conduits, and although this may be more economical on the original installation, it brings upon the owner a very heavy burden at a later date if the type of current is changed to alternating.

Headquarters for
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CONTRACT DEPARTMENT
COMMONWEALTH EDISON COMPANY

72 WEST ADAMS STREET, CHICAGO
Room 1022

Randolph 1200, Local 155

DOMESTIC MECHANICAL REFRIGERATION

By G. D. WETHERBEE, Refrigeration Engineer.

Domestic Mechanical Refrigeration has become a basic industry in the United States. Moreover, it is a major industry, comparable in importance to heating and plumbing. It is as much a part of the modern home or apartment as steam heat or running water, and no new dwelling is now constructed without considering refrigeration as a necessity. Mechanical refrigeration is no longer a novelty; it has long ago ceased to be even a luxury.

Saturation.—In spite of these facts, only eleven percent of the homes in the City of Chicago enjoy mechanical refrigeration. According to a sweeping survey recently completed by the Commonwealth Edison Company, it is divided as follows:

Class A homes.....	80%
Class B homes.....	42%
Class C homes.....	11%
Class D homes.....	5%

Eight Hundred Thousand refrigerators will be sold in 1930 according to reliable estimates, and it is reasonably certain that one million will be manufactured and sold in the United States in 1931.

The Advantages of mechanical refrigeration over the old ice-melting methods are outstanding, and the educational work of the principal manufacturers has made the public realize that they are facts. The following are included:

1. Temperature below 50° at all times. Food will keep nearly twice as long at 45° as at 55°.
2. Temperature never below freezing point as when food is stored outdoors in winter.
3. Uniform temperature.
4. Dry refrigeration. At a given temperature bacteria development in dry air is much less rapid than in moist air.
4. Cleanliness.
6. No ice worries.
7. Clean ice for table use.
8. Frozen delicacies.

Economy of Operation.—With a given refrigerator, it costs less than half as much for electricity as for ice. It would cost even less for the **same temperature** as with ice. An average five cubic foot electric refrigerator may be expected to use between 40 and 60 kilowatt-hours a month according to location, usage and weather conditions. At three cents a kilowatt hour (which the Chicago "room rate" makes possible) the cost of operation would be from \$1.20 to \$1.80 a month for such a box. At 60 cents a hundred pounds, ice for the same box would cost \$4.00 to \$6.00 a month if kept well filled at all times.

This is the least part of the economy, however, as better food storage conditions eliminate food spoilage of at least \$1.00 a week even in small families. Some authorities place this figure at \$2.00 a week and correspondingly higher in large families. Ability to buy ahead when prices are right affect another great economy. Savings from the standpoint of health and sanitation cannot be calculated but must also be considered.

The Renting Public demands mechanical refrigeration and few modern homes or apartments are without it. Owners of old buildings realize that the installation of refrigeration is an effective means of holding tenants.

Architects and Builders know they must include mechanical refrigeration in all new buildings, but few of them have any idea of

how they work. This fact is largely responsible for many unsuccessful installations.

HOW IT WORKS.

All electric refrigerating systems operate on the same principle; that a liquid in boiling or evaporating absorbs heat. The liquid must naturally boil at a very low temperature. The boiling (changing from a liquid to a gas) takes place in the **cooling coils**. As it boils, the gas is sucked from the coils and pumped to a high pressure by a **compressor** at this high pressure, and with the cooling effect of air or water circulating around the **condenser**, the gas becomes a liquid again and re-enters the cooling coils through a **pressure reducing valve**.

The **electric motor** does not do any cooling; it merely drives the compressor. Hence, refrigeration work of any kind is not an electrician's job as so many believe. Refrigeration installation and service is a specialized field entirely different from that of any other kind of machines or appliances.

Gas heated absorption machines operate on exactly the same general principle. In such equipment, the energy of the gas is directly applied without the use of a motor or compressor, and the refrigerant is compressed by driving it out of a solution with water by means of heat. Electricity may be used as the source of heat instead of gas, but at prevailing Chicago rates, the cost of operation would be considerably increased.

COMPRESSORS

All electric refrigerating machines have a compressor, and a motor to drive it. Most of the standard makes have single acting reciprocating compressors with either one or two cylinders. Rotary compressors are being used by some manufacturers but they are not common.

Gas heated absorption machines have a "generator" which takes the place of the compressor.

CHILLING UNITS.

The two general forms of chilling units (lowsides) are **open coils**, and **tanks** with the coils submerged in brine or alcohol solution. The former gives quicker cooling and the latter more even temperature and longer "hold-over" in case of mechanical trouble. Chilling units are variously known as coils, tanks, boilers, units, etc. Some have the pressure reducing valves built into the chilling unit and some are separate.

PRESSURE REDUCING DEVICES

Three distinct methods are used to reduce the high pressure liquid from the condenser to the low pressure and corresponding low temperature of the cooling coils. All are being used successfully by leading manufacturers. First, automatic expansion valve, which maintains a predetermined pressure in the cooling coils. Second, high side float valve, whose function is to drain high pressure liquid from the condenser as fast as it forms. Third, lowside float valve, which maintains a fixed liquid level in the cooling coils. The latter method is almost exclusively used in multiple installations.

AUTOMATIC CONTROL.

All modern electric refrigerators are started and stopped automatically and need no attention in this respect from the user. None of the standard makes are controlled directly by the temperature of the food compartment itself, however, but are set to maintain the chilling unit between certain limits (normally about 18° F.). Such a setting gives refrigerator temperatures of from 40° F. or lower in cool weather to about 50° F. in hot weather.



THE LAST WORD IN ADVANCED REFRIGERATION

Frigidaire Advanced Refrigeration offers a complete line of dependable refrigerating equipment for every requirement.

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Two types of controls are in common use. First, thermostat control, where the motor circuit is opened and closed by an independent device according to the temperature of the chilling unit. Second, pressure control, where the pressure of the refrigerant itself (which varies directly according to the temperatures) operates the switch. The former seems to be the most direct and positive method. The latter requires no wiring beyond the machine itself and is almost universally used in the case of multiple installations.

Sealed Machines have become quite popular within the last year or two. They include all the parts listed above, but instead of separate assemblies connected together, all the parts are grouped within a single housing, even the electric motor. The advantage of such an arrangement is that there is less chance for leaks and belt trouble is eliminated. The obvious disadvantage is that in case of a minor fault a sealed machine cannot be repaired in the home, but the entire mechanism must be replaced and repaired at the factory. Which method will prove most satisfactory and economical in the long run is still a question. Most sealed units are placed on top of the refrigerator instead of beneath it.

Ventilation for air cooled self contained refrigerators is still frequently overlooked by architects and owners. All the heat removed from a refrigerator is dispersed into the air surrounding the condenser of the machine whether it be on the top or in the base. Failure to remove this heated air results in decreased efficiency and increased wear on all the parts. For the same reason, no air cooled machine or refrigerator containing or supporting an air cooled machine should even be placed in a small unventilated room. No general rule of ventilation is possible, but common sense is usually sufficient when the reason for adequate ventilation is understood. It is obvious that, first, a large room is preferable to a small one for a self contained refrigerator; second, a refrigerator with the machine in the base should be placed two or three inches from the wall; third, no refrigerator should be placed in a tight recess or alcove; fourth, when possible, as in private homes, the machine should be installed in the basement.

REFRIGERANTS.

All refrigerating devices use liquid chemicals with very low boiling points, and it is the boiling of these chemicals which removes the heat. Electricity (or fuel gas) is used only to re-liquify them after boiling; it does not do the actual cooling. All chemicals or gases except pure air are poisonous to a more or less degree. If they are in sufficient quantity to be harmful, they should have a strong odor of irritant character to give warning of their presence.

Before the advent of small domestic machines, only ammonia and carbon dioxide were commonly used. For domestic use, carbon dioxide had too high a pressure and with ammonia, no copper or brass metals could be used.

Therefore, sulphur dioxide (SO_2) was developed and later methyl chloride (CH_3Cl).

Because of its high solubility in water, ammonia is the only refrigerant which may be used in gas heated absorption systems.

The efficiency of all refrigerants is almost equal regardless of their working pressures or boiling points.

TYPES OF REFRIGERATION INSTALLATIONS.

There are three general methods of installing mechanical refrigeration for apartment buildings, hotels, etc.

First, **self-contained refrigerators** with a separate small machine for each box.

Second, **multiple system** with machines in the basement, but with the refrigerant evaporated directly in the various boxes. Insulated pipe lines are unnecessary. It usually consists of two small copper tubings leading to each box, neither of which is cold.

Third, **brine circulation** or central plant with a large machine and brine tank in the basement from which brine is circulated through coils or special radiator sections in the various boxes. While this method it is possible to confine all the refrigerant and mechanisms to the machine room, but all the connecting pipe lines must be insulated with molded cork covering or other material which, if not perfectly applied, may condense moisture from the air and cause wetness in the walls and floors. It is rarely necessary to enter the apartments for service purposes and only harmless brine circulates through the building and refrigerators. Brine circulation is the oldest method, but has been superseded by the methods described above.

REFRIGERATOR CABINETS.

Although wooden refrigerators are better than steel from the standpoint of heat leakage, they are rapidly being superseded by steel cabinets. The low temperatures obtained with electric refrigeration make it difficult to manufacture low priced wood cabinets which will not warp, crack and swell. A well designed, well built cabinet made of seasoned lumber with the paint scientifically applied is preferable in many ways to a steel one. For the same price, however, modern steel boxes are usually more satisfactory than wooden ones. In the best refrigerators, the steel is lead coated to prevent rusting. The door frames should never be metal as it conducts heat too well. There should be no metal to metal contact any place between the interior and exterior shells.

Cork board is the standard insulation at present. Its heat conductivity is not much lower than other good insulating materials, but its advantage for cold storage purposes is that it is less affected by moisture of condensation than other materials. In the best boxes, it is carefully fitted with as few joints as possible, and all surfaces and cracks are poured with hot asphalt to make an air tight shell. In cheap boxes, the cork slabs are merely laid in the wall with no attempt at sealing the joints.

Mineral wool, when dry, is almost as good an insulation as cork board, but unless thoroughly waterproofed, it becomes damp and loses this property to a great extent. Mineral wool is made of rock, finely blown, and will therefore never rot or deteriorate. It is also strictly fire and vermin proof. If properly applied, it is an excellent insulating material.

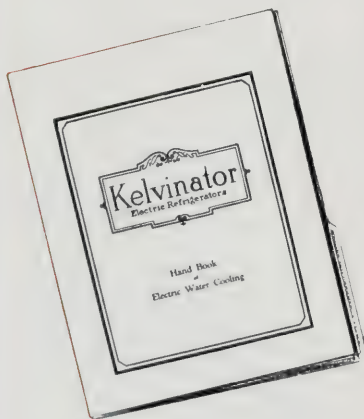
During the past year, "Dry Zero" has been extensively used, and if it stands the test of



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(213)

age, may be classed as an excellent refrigerator insulation.

The use of "celotex" has also increased. If properly waterproofed, it is undeniably a good insulating medium.

Many other materials and combinations of materials are used for refrigerator insulation including balsam wool, granulated cork, many fiber compounds, and insulating paper.

Insulation is applied in thicknesses of from one inch in cheap cabinets to three inches in the best. Two inches in the sides and top and three inches on the bottom is common for a medium size domestic refrigerator.

The interior of the best modern boxes is porcelain fused on a seamless steel lining with rounded corners. There are no joints or seams except where it is fastened to the front frame. Cheaper boxes have painted interiors of galvanized iron. The exterior of most cabinets is two or three coats of lacquer applied over the proper base coats, although some fused porcelain boxes are being sold.

The modern tendency is to eliminate all panels in the doors and sides of the cabinets, to remove as much trimming and metal work as possible, and produce a flat, smooth exterior which may be easily cleaned. There is some demand for colored boxes to harmonize with kitchen color schemes.

Domestic electric refrigerators are made in sizes ranging from three to fifteen cubic feet food storage capacity. More than half of all those in use are approximately five cubic feet. Most families do not purchase refrigerators large enough for their purposes.

UPKEEP AND ATTENTION.

The motor of most electric refrigerators needs occasional oiling. This should be done regularly by the user. The compressor oil need be changed only at long intervals, sometimes never within the life of the machine.

When the frost becomes too heavy on the chilling unit, it must be removed by turning the machine off until all the frost melts. Knives or sharp implements should never be used to chip off ice or to pry out ice cube trays. Care should be taken to empty the pan provided for this purpose unless the drain is connected to a sewer. Two weeks is the average time for defrosting, although it varies greatly according to how the box is used. A rough rule is to defrost when the frost is as thick as one's finger. Slow or rapid frost formation has nothing to do with the mechanism; it comes only from moisture in the air or from foods in the refrigerator. Warm dishes should never be placed in the box and liquids should be kept covered. The door should be opened as seldom as possible.

Being a piece of machinery, mechanical attention must be expected at intervals. There is no mechanical refrigerator which will "never give any trouble." Most faults become apparent soon after installation and the dealer should rectify such faults promptly and capably. Therefore, it is of the utmost importance in purchasing a mechanical refrigerator to consider the dealer, his reputation, his reliability, his permanence, and his service organization rather than mechanical features, refrigerants, etc., which are all good if handled properly. A mechanical refrigerator is no better than the dealer behind it.

BUYING AN ELECTRIC REFRIGERATOR.

In buying a mechanical refrigerator, the points to be considered are as follows in the order given:

1. Dealer.
2. Mechanical reliability.
3. Convenience.
4. Noise.
5. Appearance.
6. Manufacturer.
7. Efficiency.
8. Price.

REFRIGERATION FOR COMMERCIAL PURPOSES.

Along with the popularity of domestic mechanical refrigeration, there is a demand for larger machines capable of supplying the requirements of larger residences, clubs, hotels, restaurants, grocery stores, florists, and small butcher shops. Manufacturers of domestic equipment have met this demand with machines of 300, 500, 750, 1,000 pounds ice melting capacity (per 24 hours) usually driven by 1-3, 1-2, 3-4, 1 horsepower motors, respectively. The latter size is capable of maintaining a 40° F. temperature in a well insulated refrigerator up to 8'-0"x10'-0"x11'-0" outside dimensions without excessive operation.

While the original cost may seem high, the economy of mechanical refrigeration is also great. In many instances, power bills of fifteen dollars a month replace ice bills of thirty or forty dollars. Refrigerator depreciation is reduced, produce losses are reduced to a minimum, and the dealer is able to deliver better quality products to his customers than with older methods. Mechanically cooled display cases are invaluable as silent salesmen.

These larger sized machines may be obtained either water cooled or air cooled, but unless the machine location is cool and well ventilated, the latter are preferable. A one horsepower machine uses only 40 or 50 gallons of water an hour during actual operation and an automatic valve shuts the water off when the machine stops. High pressure cut-outs and other necessary safety devices are usually included.

Where there are two or more separate refrigerators in one store or restaurant, the modern method is a separate machine for each one instead of using one large machine to cool them all. In this way, separate temperature control for each refrigerator is possible, one box may be shut off or defrosted without affecting the others, and cold losses from long covered pipe lines are eliminated. It is especially important that a water cooler, ice cream cabinet, or other special fixture has its own separate machine.

Machines for the commercial field of mechanical refrigeration are now developed to a high degree of efficiency and reliability and their adaptation to the many types of commercial fixtures is almost unlimited. In almost every case where cold is required, mechanical refrigeration can do it better. The greatest fault in this field has been the use of machines too small for the work, due to price competition. In purchasing such equipment, the public is cautioned to compare prices only after comparing the size of the machine and cooling coils; also to buy from dealers in a position to fulfill their guarantee.

Modern living conditions demand the utmost in domestic convenience. Gas appliances are compact, attractive and efficient, make no dirt, and allow full use of the basement.

Auxiliary Heating
House Heating
Water Heating
Refrigeration
Cooking

Call Architects and Builders Service Division of the Gas Company for full information about FREE planning and architectural service and special prices of gas appliances in quantity purchases.

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The Peoples Gas Light and Coke Company

GAS FITTERS' RULES

Of the Peoples Gas, Light and Coke Company

OFFICE BUILDINGS, DWELLING HOUSES AND FLATS MANUFACTURED GAS FOR LIGHT

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GENERAL INSTRUCTIONS.

1. Inspection of Piping.

Piping must be inspected by the Gas Company after it is completed and before the interior of the building is lathed or covered.

Twenty-four hours notice will be required for each inspection. Gas fitters must have the work completed and the piping tight before they notify the Gas Company to make inspection.

2. Testing.

Before fixtures are installed, the piping must stand a pressure of 6 inches on a column of mercury without showing any drop in the column for a period of ten minutes.

After fixtures are installed piping must stand a pressure of one inch on a column of mercury without showing any drop for the same period of time.

3. Back Pressure Valve.

When compressed air, oxygen or any other mixture under pressure is used with gas, an approved safety back pressure device must be placed on piping to prevent pressure backing up into meter.

4. Obstructions in Pipe.

All piping must be free from burrs and other obstructions.

5. Piping for a Master Meter.

Pipe run for flats where a master meter is to be set will be installed in the same manner as is done for a single flat.

One riser only is required, and each apartment connected in to this one riser on the different floors.

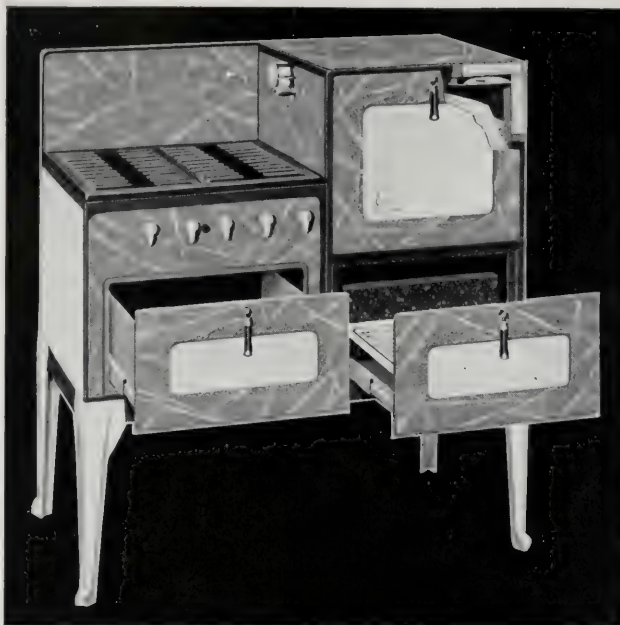
It is not required that each apartment have a separate riser.

6. Defective Material.

Split pipe or fittings must be removed and in no case repaired with cement, lead or caulked.

7. Material Not Allowed.

Unions or bushings must not be used in work that is to be concealed, and cast iron fittings are prohibited in either exposed or concealed work.



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A New Universal Console Range **The ETON UNIVERSAL**

The Eton Universal, with its marbleized porcelain finish is a range of superb beauty—a beauty that is irresistibly appealing and refreshingly new.

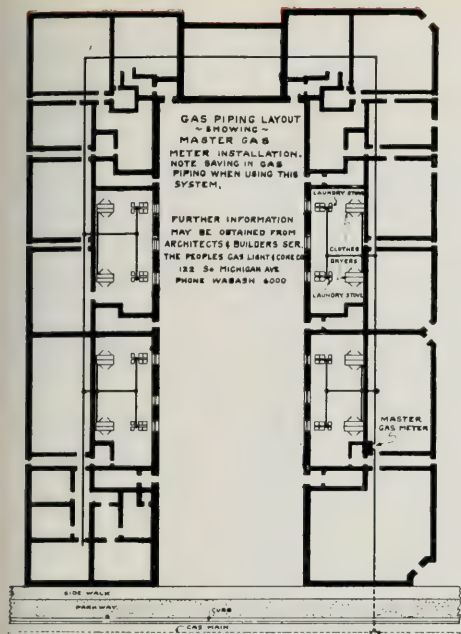
Beauty, however, is but one of the many points of superiority of this remarkable range. Automatic maintenance of oven heat—Insulated Heat Retention Oven, and In-A-Drawer Broiling and Service Compartments are but a few of the numerous modern conveniences which the Eton offers.

The most sensational fact in connection with the Eton Universal is value. At its amazingly low price, it gives greater value per dollar of cost than any gas range ever before offered by any manufacturer.

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Chicago, Illinois



8. Capping Outlets.

All outlets must be securely closed with iron caps until fixtures or appliances are installed.

9. Piping on Outside Wall.

When it is absolutely necessary to run pipe on an outside wall a furring strip must be placed between the pipe and the wall.

10. Piping on Masonry Walls.

All piping run on masonry wall must be furred out and must be securely fastened thereto by strapping it to wooden plugs driven into the wall.

11. Imbedding in Concrete or Cement.

When pipe is to be imbedded in concrete or cement, it must be covered with tar paper or other suitable covering, or laid in a conduit pipe.

12. Trapping Pipe.

To avoid trapping pipe, gas fitters must grade the pipe to riser or to drops.

13. Breaking Sizes.

In every case when an extension is to be made, pipe must be broken at a point where the full size can be maintained. No extension must be made from a pipe of a smaller size.

14. Drops from Branch Lines.

Drops on branch lines should have a set of 4 inches and they must be dropped square. Outlets for side brackets may be either square bends or long drop ells. The use of nipples is prohibited.

15. Connecting Appliances.

Fitters are particularly requested to see that gas burning appliances are connected solid with iron pipe, with the exception of portable appliances which may be connected by approved metallic tubing.

16. Shut Offs on Fuel Runs—Master Meters Supplying.

A shut off must be installed in the apartment to be supplied, at the appliance, on

every fuel run where a master meter is to be used.

This permits control of gas in each apartment without shutting off the master meter.

17. Typesetting Machines.

A linotype or monotype machine must be supplied by a separate fuel run.

RULES AND TABLES FOR PIPING.

18. Single Pipe System.

The following tables and rules provide for a single pipe system in either new or old buildings. However, should it be more economical to install a double pipe system, such may be installed, and outlets computed on the same basis as that for a single pipe system.

19. Understanding Rules.

If, in any instance, the rules governing the sizes of pipe to be installed are not clearly understood, or if unusual conditions not covered by the rules are met with, the Gas Company should be consulted.

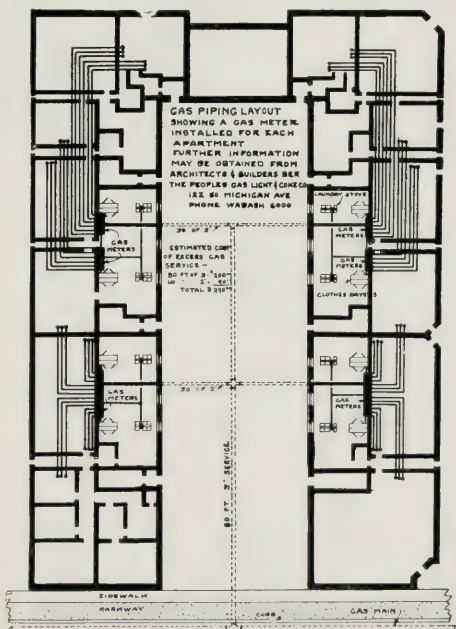
20. Location of Meter.

The Company reserves the right to determine in all cases the location for the meter.

21. Locations for Risers and Meters.

All risers must be located to conform with the following requirements:

All meters hereafter installed on consumers' premises must be located in the basement, or on the first floor as near as possible to the service entrance in a clean, dry, safe place not subject to wide variation in temperature. No meter hereafter installed



shall be placed in coal or wood bins, on the partition forming such bins, or in any location where accuracy may be affected by exposure to the elements.

22. The Following Locations Are Specifically Prohibited.

Under a bulkhead or show window, attic, sitting room, bed room, bath room, closet, stairway closet, over a door or window, under a sink or wash stand, over a gas or electric light fixture or in any location where the visits of the meter reader will cause annoyance to the customer.

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Perfectly styled to modernize and beautify the kitchen. Stippled finish—full porcelain enamel. Gray and white or green and cream or stippled green and black marble color combinations. Just the range for modern homes and apartments.

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Safety Door Manifold Cover
Robertshaw Oven Heat Control
Insulated Ovens
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MEASUREMENTS

Oven . . . 16x12½x19½ in.
Broiler . . . 16x8½x17 in.
Small Utensil
Drawer . . . 16x6x18 in.
Large Utensil
Drawer . . . 16x8½x18 in.
Cooking Top . 18½x21½ in.
Top Overall . . 37x21 in.
Height of Cooking
Top 36½ in.
Height with Top
open 58½ in.
Floor Space . . 41x27 in.
Weight 300 lbs.

Write for descriptive folder and details.

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CROWN

The Better Gas Range

Meters shall not be set so close to any source of artificial heat as to subject them to a temperature exceeding 75 degrees Fahrenheit. On all new installations a meter must be installed in a location where a temperature no lower than 40 degrees Fahrenheit is maintained.

23. Height of Risers.

Risers for stores and factories must not be more than nine feet from the floor, or of sufficient height so that the bottom of meter will not be closer than 6 inches from the floor.

No riser must be placed in a basement less than 6 feet in height.

Risers in a residence or flat building must be placed as near the ceiling as possible but must extend 2 inches below the ceiling. If meters are to be double decked, no riser must be lower than 3 feet from the floor, so that the bottom of the meter will not be closer than 6 inches from the floor.

24. Size of Pipe Required and Equivalents.

Ten cubic feet of gas will be considered as an equivalent. In order to obtain the size of pipe required to supply one or more appliances, table on appliances must be consulted and the total number of equivalents allowed the appliance, will be used to determine the sizes and length of pipe to be run as shown in the tables for piping.

Where equivalents desired are in excess of equivalents shown in piping tables, the next larger size pipe must be used.

Appliance	Equivalents Allowed
Domestic Ranges	10
Water Heaters	6
Radiantfires, Radiators	4
Space Heaters	4
Laundry Stoves	3
Light openings, such as in Kitchens and bathrooms	1
Washing Machines	3
Ironing Machines	4
Clothes Dryers	4
Incinerators	3
Ice Machines, Style "A"	5
" " Style "B"	9
" " Style "C"	12

NOTE: The above is a list of appliances commonly used in residences and apartment buildings together with the allowable equivalents for each appliance.

25. Domestic Type of Storage and Tank Water Heaters.

The City ordinance pertaining to the installation of water heaters, which is as follows, must be observed:

CITY ORDINANCE.

"1902. Permit Required to Install or Connect Gas Water Heaters.

"No person, firm or corporation shall, install or connect any hot water heater in any building or structure, for heating water in the same by the use of natural or artificial gas as fuel, within the City of Chicago, without first having obtained a permit as hereinafter provided.

"1903. Application—Permit—Fee.

"Any person, firm or corporation desiring to install or connect any water heater in a building or structure for heating water for use in such building or structure by the use of natural or artificial gas as fuel, shall file with the Commissioner of Health of the City of Chicago, an application upon form furnished by the Department of Health, containing the name of the applicant, the street number of the building in which the said heater is to be used (and if the building is an apartment building, the location of the apartment) the floor plan of the room, showing the proposed position of the heater, the location of the plumbing fixtures, the door and window openings, showing their dimen-

sions and the course of the gas duct or ventilating pipe to the outer air or to a chimney connection provided, however, that no such gas water heater shall be installed in any bathroom or toilet room.

"If such application is approved by the Commissioner of Health, it shall be the duty of the City Clerk to issue a permit to the applicant upon the payment by him of a fee of one dollar for every non-automatic heater and three dollars for every automatic heater desired to be installed or connected.

"1904. Structural Requirements. No person, firm or corporation shall install or connect any such heater unless it be provided with a metallic hood to which there shall be connected a suitable ventilating pipe not less than two inches in diameter, which said pipe shall extend to a chimney flue or to the open air in such a way as to carry off all escaping gases or fumes from such heater. In case such ventilating pipe shall not extend to the open air, it shall be provided with a cap or cowl so as to prevent a back draft. Every such heater or gas oven shall be provided with a convenient and adequate means of access to the burners and heating surfaces for the purpose of lighting and cleaning same. No such gas water heater shall be set closer to the floor than twenty inches, measuring from the top of burner.

"1904 a. Automatic Instantaneous Gas Water Heaters. All instantaneous gas water heaters, automatically controlled by pressure valve and thermostat, shall conform to the foregoing structural requirements, except that they may have pilot lights located entirely within the casing and arranged for continuous burning, and that they may set with top of burners not less than eight inches above floor; provided, that every such heater shall be set on a non-combustible floor or a sheet metal mat or pan and that the walls behind shall be protected by a sheet metal covering to the height of the heater.

"1905. Duty of Owner or Person in Possession of Heater. It shall be the duty of the owner or person in possession or control of any building or structure where gas water heaters have heretofore been installed to make such heaters comply with the requirements of this article, and it shall be unlawful for any person to use any such heater until it shall have been made to conform to the provisions of this article.

"Section 2. This ordinance shall take effect and be in force from and after its passage and due publication."

26. Automatic Water Heaters.

To obtain size of pipe required to connect automatic water heaters, consult Table of Appliances for equivalents and obtain size and length of pipe required as is shown in Table No. 30.

The following types of heaters may be taken from existing piping provided it is of sufficient size to supply appliances already connected in addition to heater.

Where existing piping is not of sufficient size to supply water heater, the table of piping should be consulted and a separate run installed for the heater.

Name	Type	Equivalents
Rex	24, # 34	6
"	42	6
Premier	0, # 1	6
"	2, # 3	6
Everhot	All Types	6
Kompak	18	6
"	32	6
Lovekin	22, # 28	6
"	35, # 45, # 60	6
Humphrey	24	6
"	40	6
Ruud	20, # 30	6
"	40	6
Linc	20	6
"	30	6

The following types of heaters will require a separate fuel-run from the meter to the appliance.

To determine the size of pipe to be used, consult table in rule 29.

Name	Type	Equivalents
Hoffman	2 1/2 D	16
"	3 H	26
"	4 H	26
"	6 H	44
"	8 H	64
Rex	66	16
Premier	4	16
Toombs	3	26
"	4	26
Radke	2 1/2	16
"	3	26
"	4	26
"	6	44
Humphrey	66	16
"	2 C	26
"	4 C	44
"	6 C	44
"	8 C	64
Rud	85	16
"	95	16
"	3	26
"	4	26
"	6	44
"	8	64
"	50	16
"	100	16
"	200	26
"	300	44
"	500	64
Pittsburgh	"	"
"	55	16
"	60	16
"	65	26
"	2	16
"	4	26
"	6	44
"	8	64
Go Ro.	3	26
"	4	26
"	6	44
American	3	26
"	4	26
"	6	44
Bryant	3 A 2	16
"	3 A 3	26
"	4 A 2	16
"	4 A 3	44
"	5 A 3	44
"	6 A 3	64
"	7 A 3	64
"	8 A 3	64
"	9 A 3	102
Humphrey	20	16
"	30	26
"	25 A	26
"	2 A	26
"	3 A	26
"	4 A	26
"	6 A	44
"	8 A	64

27. Interior Piping for Industrial Appliances.

Due to the many different types of Industrial Appliances and their wide variation of capacity, a table is not easily shown. It is therefore advised that where appliances are to be used for industrial purposes, such as candy furnaces, water stills, soft metal furnaces, japanning ovens, heat treating furnaces, forges, brass melting furnaces, etc., that the Industrial Department be consulted before piping is installed.

28. Size of Opening.

To determine the size of the opening required when risers are connected at the meter end, the combined loads of the risers must be added together. (See table in rule No. 30.)

29. Size of Riser for Combined Lines.

When two or more lines of pipe are connected in order to be supplied by one riser, the riser must be of sufficient size to supply the combined load of all the lines. (See table of Equivalents.)

30. Office Buildings, Schools, Hospitals, Residences and Apartments.

Size of Pipe	Feet of Pipe Allowed	Number of 3/4" Equivalents All'd
3/8"	30	4
1/2"	50	6
3/4"	60	16
1"	100	26
1 1/4"	125	44
1 1/2"	150	64
2"	200	102
2 1/2"	250	160
3"	300	240
4"	400	450

In piping for lighting, each 3/8 inch opening will be considered as one equivalent.

No fuel run to a range or combination of appliances other than a laundry stove must be less than 3/4 inch pipe. 1/2 inch pipe is allowed for laundry stove runs, only where direct extension is from meter.

It is permitted under the rules, in addition to what equivalents are allowed, to take off a 3/4 inch pipe, one light opening in a kitchen or bathroom, and a laundry stove. No other additional combination is allowed on this size of pipe.

In planning piping, cross reference to determine the number of equivalents must be made to table showing equivalents allowed for various appliances.

Fifteen feet of 1/2 inch as shown in sketches on pages 21 and 22 is allowed for laundry stoves, radiants, radiators, etc.

No opening less than 3/4 inch is allowed for a range as shown in tables for piping.

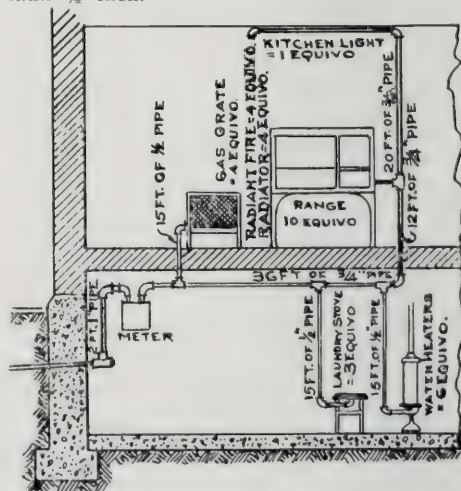
31. Stores, Factories, Hotel and Restaurant.

Size of Pipe	Feet of Pipe Allowed	Number of 3/4" Equivalents All'd.
3/4"	60	16
1"	60	33
1 1/4"	80	60
1 1/2"	120	76

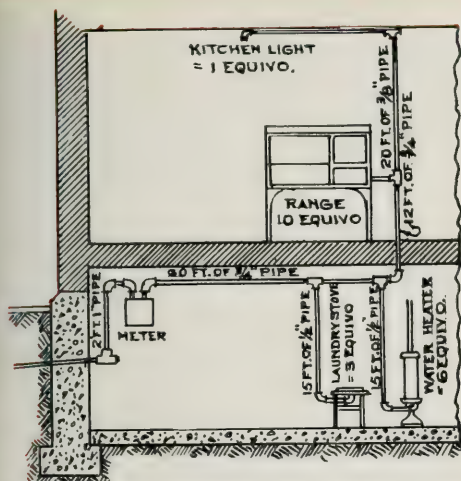
When installing piping for Hotel and Restaurant appliances, the rule of pipe sizes and consumption table of appliances will be observed where piping not larger than 1 1/2 inches is required. Where large appliances are to be installed requiring piping of a larger size than 1 1/2 inch, the Hotel and Restaurant Department should be consulted.

Thirty feet of 1/2 inch pipe for branches will be allowed off of any one opening.

No running line for stores must be less than 3/4 inch.



Sketch showing piping plan for apartment or residence when heating appliances, range, water heater, laundry stove and kitchen light are to be used; also showing ten feet of one inch pipe to first opening.



Sketch showing piping plan for apartment or residence when range, water heater, laundry stove and kitchen light are to be used.

This is the maximum of appliances allowed to be taken from a $\frac{3}{4}$ inch line.

A store having a width of more than 30 feet (such as a double store) must have a running line of not less than 1 inch in size.

32. Building Services.

Size of Pipe	Feet of Pipe Allowed	Number of $\frac{3}{4}$ " Equivalents All'd.
1 "	70	20
1 $\frac{1}{4}$ "	90	40
1 $\frac{1}{2}$ "	110	70
2 "	150	120
2 $\frac{1}{2}$ "	200	180
3 "	250	300
4 "	350	550

NOTE: All openings in a building service must be of the same size as that of the riser, which in no case must be less than $\frac{3}{4}$ inch in size.

This rule will permit of running different sizes of pipe as building services, provided the consumption corresponding to the smallest size of pipe in the run is used.

No building service for stores must be less than $\frac{1}{4}$ inch in size.

33. Riser for Theatre.

A meter to supply a theatre may be set in a public meter room with other meters and may be supplied by the service supplying those meters.

34. Piping for Laundry Room.

In a flat building where appliances such as laundry stoves, driers, etc., are installed for the joint use of tenants, a pipe from each tenant's meter must be run to the laundry room, and a header provided on the wall adjacent to the appliance. Each riser must be equipped with a lock cock.

A metal tag with the flat number plainly marked thereon must be securely fastened to each cock.

One outlet for a light in the laundry may be taken from the end of the laundry header.

35. Vestibule Partition.

A riser must not be run closer than one foot to a vestibule partition.

36. Electric Cut Off Box.

A riser must never be brought to a point nearer than 5 feet from an electric cut off box.

37. Exit Lights.

When running pipe for exit lights in theatres, schools, amusement or assembly halls, it must be done in accordance with the city ordinance.

38. Outlets—Distance from Ceiling Wall or Floor.

If the pipe has been run under the floor, the outlet for fuel in a kitchen must be left 3 inches above the floor and two inches clear of the baseboard. If the pipe has to be run overhead and down, the outlet must be left 3 feet from the floor and 2 inches clear of the finished wall.

Wall or ceiling outlets must be produced $1\frac{1}{2}$ inches below an unfinished ceiling, or $\frac{5}{8}$ inch below a finished one. In a store the outlets must be produced $2\frac{1}{4}$ inches below an unfinished ceiling, and $1\frac{1}{2}$ inches below a finished one.

An outlet for a mantel or fireplace must be produced $\frac{1}{2}$ inch above the finished bottom of the fireplace, 6 inches from the left or right hand side, and 6 inches from the back.

39. Building Service Only.

In figuring for building service only for buildings where consumption is not known, the following rule will allow for a building service of sufficient size to meet ordinary requirements.

Should an owner contemplate using gas for industrial purposes, the Industrial Department must be consulted for size of pipe.

Allow two cubic feet of gas for each 10 square feet of floor space on each floor, then consult table in rule No. 32 for number of equivalents which will determine size of openings for each floor, repeat this rule for all floors.

Add total consumption for all floors which will determine the size of pipe, starting at street service, then reduce size of pipe as openings are taken off to comply with tables of piping for length, etc.

If the number of equivalents figured for the building comes between any two number of equivalents as shown in table No. 30, always use the larger number of equivalents which will determine the proper size of pipe to run.

40. Building Service in Flat or Residence.

A building service for flat building or a residence must be run over-head and brought down in an inside partition not less than 4 feet from an outside wall.

No building service must be run under a basement floor or under a first floor where there is no basement.

41. Building Service in Store, Factory, and Garage.

A building service in a store may be run over-head if the entire horizontal run of pipe can be graded to the street service. If not, it must be run under the floor and graded to street service.

When a building service is run over-head it must be brought down at least 4 feet from the front wall of the building.

When it is necessary to extend a building service underground from the front to the rear of a store or factory building, it must be encased in tile pipe with cemented joints.

Gas fitters must not do any underground piping outside of a building.

42. Solid Wall Porch.

In a building with a solid wall porch, the building service must be run to the front and then to the side wall.

43. Location of Building Service.

When risers are located in the rear of a basement or in a room provided for that pur-

pose, or on the various floors, the building service must be brought to within 18 inches of the wall through which the street service will be produced.

44. Wrapping Building Service.

A building service run under an open porch connecting the front and rear sections of a building, must be covered with mineral wool or steam pipe covering and boxed in.

45. Encasing Building Service.

A building service laid through a masonry wall must be encased and the pipe left resting on the bottom of the casing with a 1½ inch clearance on top.

46. Opening in Building Service.

The opening in a building service should always be on the left hand side of the riser which it is to supply.

See table for meter sizes and dimensions for distance to be spaced.

47. Test Pipe to Prove Work.

Every building service must have a ¾ inch test pipe to which a gauge can be attached.

48. Building Service Header.

When it is necessary to set more than two meters together, a building service header must be supplied with an opening for each meter. All openings must be faced up sufficiently to allow condensation to drain to the service.

49. Services for Stores.

A building containing stores must have a separate service for each store, unless a public meter room or other public place on the floor or below that where the gas is to be used is provided.

Where owner desires two separate services in one trench, each building service must be terminated at least 2 feet clear of the doorways.

50. Services for Apartment Buildings.

In apartment buildings of 12 flats and under, only one Company's service will be allowed. This will make it necessary to connect the various building services supplying the groups of risers regardless of fire walls, and extend one building service to the point where the Company's service will come in.

In apartment buildings containing more than 12 flats, two or more Company's services will be allowed.

51. Services for Court Buildings.

In a building which faces on a parkway or has a parkway or court in the center, the Gas Company will run one service in the court or parkway, and branch therefrom to supply the various building services.

The gas fitter may run building services through fire walls and connect them, but these must be extended as close to the front of the building as possible.

Any building service in a court building must not be terminated in a finished room.

See sketch of court building on page 401.

52. Locating Service to Corner Building.

To avoid complications when working on a corner building, the gas fitter should obtain from the Gas Company a written notice giving the exact location where the Company's service will enter the building.

53. Building in Rear of Corner Lot.

A building on the rear of a corner lot must be supplied from the side street if a gas main is on that street. It may be supplied either from the front building or by a long service run in the parkway from the main supplying the front building provided that at no point this long service will have less than 2 feet of cover. Bearing in mind

that if possible the services must be extended in such a manner as to avoid using a drip.

Should a long service be used in the parkway, a separate ticket for the long service must be used as the customer is allowed 100 feet of pipe free and must pay for the balance. A service order will be used for the service taken from the pipe extended in this manner and will be treated the same as any new service.

54. Building in Rear of Lot.

When a building in the rear of a lot is to be supplied, a separate service should be used wherever possible. If, however, an independent supply is not practicable, the building service for the front building, if there is one, must be extended to the rear of the building, and of a size not less than 1½ inches to the rear building, which can be supplied from it also.

In all cases where a supply to a rear building is desired the Gas Company must be consulted.

55. Opening in Wall for Service.

In a new building, an opening should be provided in the wall for the Gas Company's service. The most preferable way is to build a sleeve of wood, rectangular in shape, 12 inches by 5 inches, with an inside partition about 6 inches from the street end of the sleeve.

Application should be made to the General Office of the Gas Company to locate the wall and the point in the wall wherein the sleeve should be built, so that when the service pipe is run, it will pass through the opening, provided therefor. In this way the damaging of foundation walls will be avoided.

56. Opening in Floor for Service.

When a service connection may have to be made above the floor level, an opening must be left in the floor so that the street service can be introduced without disturbing anything.

The District Shop will on notification instruct the gas fitter where to leave this opening.

57. Bringing Building Service to Street Service.

When the Company's service is extended into a building before the house-piping is completed, the building service must be brought within 18 inches of the wall at a point where the street service enters the building except where the company service comes through the bay, then the building service must be brought to the nearest corner of the bay.

58. Terminating Building Service.

A building service must not be terminated in, or run in such a manner that the street service will be opposite or under a coal chute, or any opening in the sidewalk so that it is liable to be broken or damaged by falling material.

59. Work Reserved.

This Company does not permit anyone but its own authorized employees to place any piping or connections on any part of either the outlet or inlet meter connections, turn on the gas, disconnect, move, or interfere in any way with its piping, meters or connections.

60. Resetting or Changing Location of Meter.

If, after a meter is once installed, the customer desires alterations in the house-piping which would necessitate the disconnecting, reconnecting or changing the location of the meter, a charge will be made by the Gas Company for this work.

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STANDARD SPECIFICATION FOR STRUCTURAL STEEL FOR BUILDINGS

As Adopted By the American Institute of Steel Construction

Abutting Joints—Section 11
Adjustable Members—Section 19
Beams and Girders
 Proportioning—Sec. 7 (a)
 Web thickness—Sec. 7 (b)
 Web splices—Sec. 7 (c)
 Web stiffeners—Sec. 7 (d)
 (Table and Diagram)
 Web shear—Sec. 5 (d)
 Flange plates—Sec. 7 (e)
 Crane girders—Sec. 7 (f)
 Flange connection to web—Sec. 7 (g and h)
Bearing—Section 5 (e)
Bending—Section 5 (c)
Bessemer Material—Section 3
Bolts
 Shearing—Sec. 5 (d)
 Bearing—Sec. 5 (e)
 Use of finished—Sec. 13 (d)
 Use of unfinished—Sec. 13 (d)
Burning Torch—Section 20 (i)
Columns—Section 5 (b)
 (Table and Diagram)
 Column base—Section 8
Combined Stress
 Direct Bending—Section 10 (a)
 Reversal Bending—Section 10 (b)
Compression—Section 5 (b)
Compression Flanges—Section 5 (c) (Table and Diagram)
Connections—Section 15
Erection—Section 22
Eccentric Loads—Section 9
Eccentric Connections—Sections 15 (b and c)
Expansion—Section 17

Expansion Rollers (Bearing)—Section 5 (d)
Fixed End Beams—Section 15 (d)
General—Section 2
Girders—See Beams and Girders
Impact—Section 4 (b)
Inspection—Section 23
Lattice—Section 16
Loading—Section 4
Material—Section 3
Net Sections—Section 12
Painting—Section 21
Pins
 Bending—Sec. 5 (c)
 Shear—Sec. 5 (d)
 Bearing—Sec. 5 (e)
Reaction Loads—Section 4 (d)
Rivets
 Shear—Sec. 5 (d)
 Bearing—Sec. 5 (e)
 For main connection—Sec. 13 (c)
 Long grip—Sec. 3 (b)
 Nominal diameter—Section 13 (a)
 Spacing—Sec. 14
Shearing—Section 5 (d)
Stresses—Section 5
Symmetrical Members—Section 6
Temporary Bracing—Section 22 (a)
Tension—Section 5 (a)
Tie Plates—Section 15 (a)
Thickness of Material—Section 18
Web Shear—Section 5 (d)
Workmanship—Section 20
Wind—Section 4 (c)
Wind Stresses
 Alone—Sec. 5 (g)
 Combined—Sec. 5 (f)

1. This Specification defines the practice adopted by the American Institute of Steel Construction for the design, fabrication, and erection of structural steel for buildings.

2. General:

To obtain a satisfactory structure, the following major requirements must be fulfilled.

(a) The material used must be suitable, of uniform quality, and without defects affecting the strength or service of the structure.

(b) Proper loads and conditions must be assumed in the design.

(c) The unit stresses must be suitable for the material used.

(d) The workmanship must be good, so that defects or injuries are not produced in the manufacture.

(e) The computations and design must be properly made so that the unit stresses specified shall not be exceeded, and the structure and its details shall possess the requisite strength and rigidity.

3. Material:

Structural steel shall conform to the Standard Specifications of the American Society for Testing Materials for Structural Steel for Buildings, Serial Designation A 9-21, as amended to date.

4. Loading:

(a) Steel structures shall be designed to sustain the dead weight imposed upon them, including the weight of the steel frame itself, and, in addition, the maximum live load as specified in each particular case. Proper provision shall be made for temporary stresses caused by erection.

(b) In cases where live loads have the effect of producing impact or vibration, a proper percentage shall be added to the static live load stresses to provide for such influences, so that the total stress found in any member is an equivalent static stress.

(c) Proper provision shall be made for stresses caused by wind both during erection and after completion of the building. The wind pressure is dependent upon the conditions of exposure, but the allowable stresses specified in section five (5), paragraphs (f)

and (g), are based upon the steel frame being designed to carry a wind pressure of not less than twenty (20) pounds per square foot on the vertical projection of exposed surfaces during erection, and fifteen (15) pounds per square foot on the vertical projection of the finished structure.

(d) Proper provision shall be made to securely fasten the reaction points of all steel construction and transmit the stresses to the foundations of the structure.

5. Allowable Stresses:

All parts of the structure shall be so proportioned that the sum of the maximum static stresses in pounds per sq. in. shall not exceed the following:

(a) **Tension:** Rolled Steel, on net section 18,000

(b) **Compression:** Rolled Steel, on short lengths or where lateral deflection is prevented 18,000
 On gross section of columns,
 18,000

$$1 + \frac{l^2}{18,000r^2}$$

with a maximum of 15,000
 In which l is the unsupported length of the column, and r is the corresponding least radius of gyration of the section, both in inches.

For main compression members, the ratio l/r shall not exceed 120, and for bracing and other secondary members, 200.

(c) **Bending:** On extreme fibres of rolled shapes, and built up sections, net section, if lateral deflection is prevented 18,000
 When the unsupported length l exceeds 15 times b , the width of the compression flange, the stress in pounds per sq. in. in the latter shall not exceed.

$$\frac{20,000}{1 + \frac{l^2}{2,000b^2}}$$

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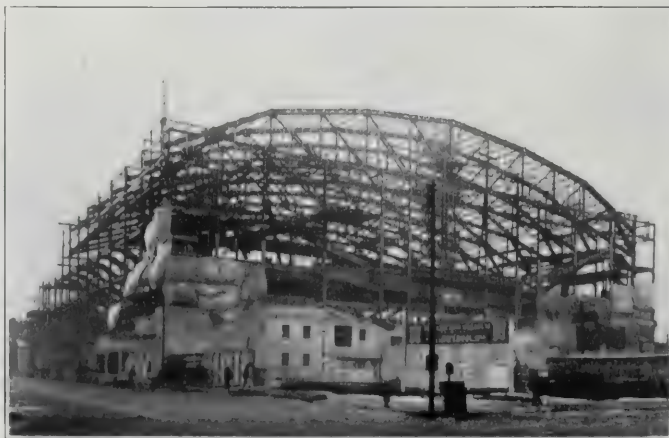
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The laterally unsupported length of beams and girders shall not exceed 40 times b the width of the compression flange.

On extreme fibres of pins, when the forces are assumed as acting at the center of gravity of the pieces... 27,000
 (d) **Shearing:** On pins..... 13,500
 On power-driven rivets..... 13,500
 On turned bolts in reamed holes with a clearance of not more than 1/50 of an inch..... 13,500
 On hand-driven rivets..... 10,000
 On unfinished bolts..... 10,000
 On the gross area of the webs of beams and girders, where h , the height between flanges in inches, is not more than 60 times t , the thickness of the web in inches..... 12,000
 On the gross area of the webs of beams and girders if the web is not stiffened where h , the height between flanges in inches, is more than 60 times t , the thickness of the web, the maximum shear per square inch, S/A shall not exceed

$$\frac{18,000}{1 + \frac{h^2}{7,200t^2}}$$

In which S is the total shear, and A is the gross area of web in square inches.

	Double Shear	Single Shear
(e) Bearing: On pins.....	30,000	24,000
On power-driven rivets.....	30,000	24,000
On turned bolts in reamed holes.....	30,000	24,000
On hand-driven rivets.....	20,000	16,000
On unfinished bolts.....	20,000	16,000
On expansion rollers per lineal inch 600 times the diameter of the roller in inches.		

(f) **Combined Stresses:** For combined stresses due to wind and other loads, the permissible working stress may be increased 33%, provided the section thus found is not less than that required by the dead and live loads alone.

(g) Members Carrying Wind Only:

For members carrying wind stresses only, the permissible working stresses may be increased 33%.

6. Symmetrical Members:

Sections shall preferably be symmetrical.

7. Beams and Girders:

(a) **Rolled beams** shall be proportioned by the moment of inertia of their net section. Plate girders with webs fully spliced for tension and compression shall be so proportioned that the unit stress on the net section does not exceed the stresses specified in section five (5) as determined by the moment of inertia of the net section.

(b) **Plate girder webs** shall have a thickness of not less than 1-160 of the unsupported distance between the flanges.

(c) **Web splices** shall consist of a plate on each side of the web capable of transmitting the full stress through the splice rivets.

(d) **Stiffeners:** Stiffeners shall be required on the webs of rolled beams and plate girders at the ends and at points of concentrated loads, and at other points where h the clear distance between flanges is greater than $85t\sqrt{18,000 (A/S)-1}$, in which t is the thickness of the web. When stiffeners are required, the distance in inches between them shall not be greater than $85t\sqrt{18,000 (A/S)-1}$, or not greater than 6 feet. When h is greater than 60 times t , the thickness of the web of a plate girder, stiffeners shall be required at distances not greater than 6 feet apart. Stiffeners under or over concentrated loads shall be proportioned to distribute such loads into the web.

Plate girder stiffeners shall generally be in pairs, one on each side of the web, and shall have a close bearing against the flange angles at points of concentrated loading; stiffeners over the end bearings shall be on plate fillers. The pitch of rivet in stiffeners shall not exceed 6".

(e) **Flange plates** of all girders shall be limited in width so as not to exceed more than 6" or more than 12 times the thickness of thinnest plate beyond the outer row of rivets connecting them to the angles.

(f) **Crane runway girders** and the supporting framework shall be proportioned to resist the greatest horizontal stresses caused by the operation of the cranes.

(g) **Rivets** connecting the flanges to the web at points of direct load on the flange between stiffeners shall be proportioned to carry the resultant of the longitudinal and transverse shears.

(h) **Rivets** connecting the flanges to the webs of plate girders and of columns subjected to bending shall be so spaced as to carry the increment of the flange stress between the rivets.

8. Column Bases:

(a) Proper provision shall be made to distribute the column loads on the footings and foundations.

(b) The top surface of all column bases shall be planed for the column bearing.

(c) Column bases shall be set true and level, with full bearing on the masonry, and be properly secured to the footings.

9. Eccentric Loading:

Full provision shall be made for stresses caused by eccentric loads.

10. Combined Stresses:

(a) Members subject to both direct and bending stresses shall be so proportioned that the greatest combined stresses shall not exceed the allowed limits.

(b) All members and their connections which are subject to stresses of both tension and compression due to the action of live loads shall be designed to sustain stress giving the largest section, with 50% of the smaller stress added to it. If the reversal of stress is due to the action of wind, the member shall be designed for the stress giving the largest section and the connections proportioned for the largest stress.

11. Abutting Joints:

Compression members when faced for bearings shall be spliced sufficiently to hold the connecting members accurately in place. Other joints in riveted work, whether in tension or compression, shall be fully spliced.

12. Net Sections:

(a) In calculating tension members, the net section shall be used, and in deducting the rivet holes they shall be taken 1/8 inch greater in diameter than the nominal diameter of the rivets.

(b) Pin connected tension members shall have the section through the pin hole 25% in excess of the net section of the member, and a net section back of the pin hole equal to 75% of that required through the pin hole.

13. Rivets and Bolts:

(a) In proportioning rivets, the nominal diameter of the rivets shall be used.

(b) Rivets carrying calculated stresses and whose grip exceeds five diameters, shall have their number increased 1% for each additional 1/16 inch in the rivet grip. Special care shall be used in heating and driving such rivets.

(c) Rivets shall be used for the connections of main members carrying live loads which produce impact, and for connections subject to reversal of stresses.

(d) Finished bolts in reamed holes may be used in shop or field work where it is impracticable to obtain satisfactory power-driven



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Moline 811

rivets. The finished shank shall be long enough to provide full bearing, and washers used under the nuts to give full grip when turned tight.

Unfinished bolts may be used in shop or field work for connections in small structures used for shelters, and for secondary members of all structures such as purlines, girts, door and window framing, alignment bracing and secondary beams in floor.

14. Rivet Spacing:

(a) The minimum distance between centers of rivet holes shall be three diameters of the rivet; but the distance shall preferably be not less than $4\frac{1}{2}$ inches for $1\frac{1}{4}$ inch rivets, 4 inches for $1\frac{3}{8}$ inch rivets, $3\frac{1}{2}$ for 1 inch rivets, 3 inches for $\frac{7}{8}$ inch rivets, $2\frac{1}{2}$ for $\frac{5}{8}$ inch rivets, 2 inches for $\frac{3}{4}$ inch rivets, and $1\frac{3}{4}$ inches for $\frac{1}{2}$ inch rivets. The maximum pitch in the line of stress of compression members composed of plates and shapes shall not exceed 16 times the thinnest outside plate or shape, nor 20 times the thinnest enclosed plate or shape with a maximum of 12 inches, and at right angles to the direction of stress the distance between lines of rivets shall not exceed 30 times the thinnest plate or shape. For angles in built sections with two gage lines, with rivets staggered, the maximum pitch in the line of stress in each gage line shall not exceed 24 times the thinnest plate with a maximum of 18 inches.

(b) In tension members composed of two angles, a pitch of 3'-6" will be allowed, and in compression members, 2'-0", but the ratio l/r for each angle between rivets shall not be more than $\frac{3}{4}$ of that for the whole member.

(c) The pitch of rivets at the ends of built compression members shall not exceed four diameters of the rivets for a length equal to $1\frac{1}{2}$ times the maximum width of the member.

(d) The minimum distance from the center of any rivet hole to a sheared edge shall be $2\frac{1}{4}$ inches for $1\frac{1}{4}$ inch rivets, 2 inches for $1\frac{3}{8}$ inch rivets, $1\frac{3}{4}$ inches for 1 inch rivets, $1\frac{1}{2}$ inches for $\frac{7}{8}$ inch rivets, $1\frac{1}{4}$ for $\frac{5}{8}$ inch rivets, $1\frac{1}{4}$ for $\frac{3}{4}$ inch rivets, and 1 inch for $\frac{1}{2}$ inch rivets. The maximum distance from any edge shall be 12 times the thickness of the plate, but shall not exceed 6 inches.

15. Connections:

(a) Connections carrying calculated stresses except for lacing, sag bars, or angles, hand rails, or beam connections, shall not have less than 2 rivets; or for field connections not less than 3 rivets.

(b) Members meeting at a joint shall have their lines of center of gravity meet at a point if practicable; if not, provision shall be made for any eccentricity.

(c) The rivets at the ends of any member transmitting the stresses into that member should have their centers of gravity in the line of the center of gravity of the member; if not, provision shall be made for the effect of the resulting eccentricity. Pins may be so placed as to counteract the effect of bending due to dead load.

(d) When a beam or girder "A" is connected to another member in such a manner that "A" acts as a continuous or fixed end beam, proper provision shall be made for the bending moments at such a connection.

(e) Where stress is transmitted from one piece to another, through a loose filler, the number of rivets shall be properly increased; tight-fitting fillers shall be preferred.

16. Lattice:

(a) The open sides of compression members shall be provided with lattice having plates at each end and at intermediate points if the lattice is interrupted. Tie plates shall be as near the ends as practicable. In main members carrying calculated stresses the end tie plates shall have a length of not less than the distance between the lines of rivets con-

necting them to the flanges, and intermediate ones of not less than one-half of this distance. The thickness of tie plates shall not be less than one-fiftieth of the distance between the lines of rivets connecting them to the segments of the members, and the rivet pitch shall not be more than four diameters. Tie plates shall be sufficient in size and number to equalize the stress in the parts of the members.

(b) Lattice bars shall have neatly finished ends. The thickness of lattice bars shall be not less than one-fortieth for single lattice and one-sixtieth for double lattice or the distance between end rivets; their minimum width shall be as follows:

For 15" channels, or built section with $3\frac{1}{2}$ " and 4" angles— $2\frac{1}{4}$ " ($\frac{3}{4}$ " rivets), or $2\frac{1}{2}$ " ($\frac{7}{8}$ " rivets).

For 12", 10", and 9" channels, or built sections with 3" angles— $2\frac{1}{4}$ " ($\frac{3}{4}$ " rivets).

For 8" and 7" channels, or built sections with $2\frac{1}{2}$ " angles—2" ($\frac{5}{8}$ " rivets), or $2\frac{1}{4}$ " ($\frac{3}{4}$ " rivets).

For 6" and 5" channels, or built sections with 1" angles— $1\frac{1}{2}$ " ($\frac{1}{2}$ " rivets), or $1\frac{3}{4}$ " ($\frac{5}{8}$ " rivets).

(c) The inclination of lattice bars to the axis of the members shall generally be not less than 45° ; but when the distance between the rivet lines in the flanges is more than 15 inches, the lattice shall be double and riveted at the intersection if bars are used, or else shall be made of angles.

(d) Lattice bars shall be so spaced that the ratio l/r of the flange included between their connections shall be not over $\frac{3}{4}$ of that of the member as a whole.

17. Expansion:

Proper provision shall be made for expansion and contraction.

18. Minimum Thickness:

No steel less than $\frac{1}{8}$ inch thick shall be used for exterior construction, nor less than $\frac{1}{4}$ inch for interior construction, except for linings or fillers and rolled structural shapes.

These provisions do not apply to light structures such as skylights, marquees, fire-escapes, light one-story buildings or light miscellaneous steel work.

For trusses having end reactions of 35,000 pounds or over, the Gusset Plates shall be not less than $\frac{3}{8}$ inch thick.

19. Adjustable Members:

The initial stress in adjustable members shall be assumed as not less than 5,000 lbs.

20. Workmanship:

(a) All workmanship shall be equal to the best practice in modern structural shops.

(b) Drifting to enlarge unfair holes shall not be permitted.

(c) The several pieces forming built sections shall be straight and fit close together; and finished members shall be free from twists, bends, or open joints.

(d) Rolled sections, except for minor details, shall not be heated.

(e) Wherever steel castings are used, they shall be properly annealed.

(f) **Punching:** Material may be punched $\frac{1}{8}$ inch larger than the nominal diameter of the rivets, whenever the thickness of the metal is equal to or less than the diameter of the rivets, plus $\frac{1}{8}$ inch. When the metal is thicker than the diameter of the rivet, plus $\frac{1}{8}$ inch, the holes shall be drilled, or sub-punched and reamed.

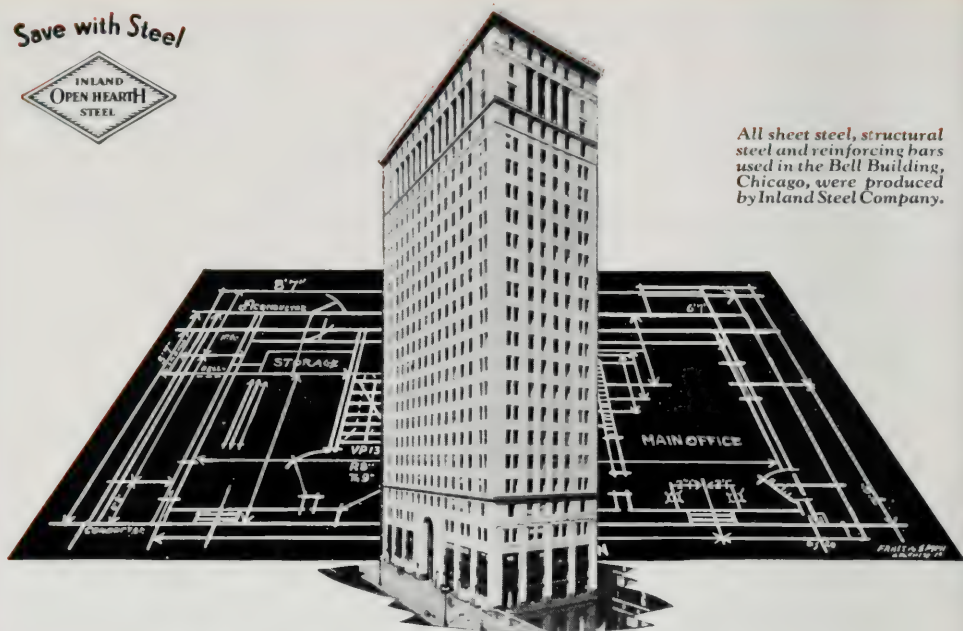
(g) Rivets are to be driven hot, and wherever practicable, by power. Rivet heads shall be of hemispherical shape and uniform size throughout the work for the same size rivet, full, neatly finished, and concentric with the holes. Rivets, after driving, shall be tight, completely filling the holes, and with heads in full contact with the surface.

(h) Compression joints depending upon

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All sheet steel, structural steel and reinforcing bars used in the Bell Building, Chicago, were produced by Inland Steel Company.



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INLAND STEEL COMPANY



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Sheets Bars Plates Structurals Rails Track Accessories Rivets Billets

contact bearing shall have the bearing surfaces truly faced after the members are riveted. All other joints shall be cut or dressed true and straight, especially where exposed to view.

(1) The use of a burning torch is permissible if the burned metal is not carrying stresses during the burning. Stresses shall not be transmitted into the metal through a burned surface.

21. Painting:

(a) Parts not in contact, but inaccessible after assembling shall be properly protected by paint.

(b) All steel work, except where encased in concrete, shall be thoroughly cleaned and given one coat of acceptable metal protection well work into the joints and open spaces.

(c) Machine finished surfaces shall be protected against corrosion.

(d) Field painting is a phase of maintenance, but it is important that unless otherwise properly protected, all steel work shall after erection be protected by a field coat of good paint applied by a competent painter.

22. Erection:

(a) The frame of all steel skeleton buildings shall be carried up true and plumb, and temporary bracing shall be introduced wherever necessary to take care of all loads to which the structure may be subjected, including erection equipment, and the operation

of same. Such bracing shall be left in place as long as may be required for safety.

(b) As erection progresses the work shall be securely bolted up to take care of all dead load, wind and erection stresses.

(c) Wherever piles of material, erection equipment, or other loads are carried during erection, proper provision shall be made to take care of stresses resulting from the same.

(d) No riveting shall be done until the structure has been properly aligned.

(e) Rivets driven in the field shall be heated and driven with the same care as those driven in the shop.

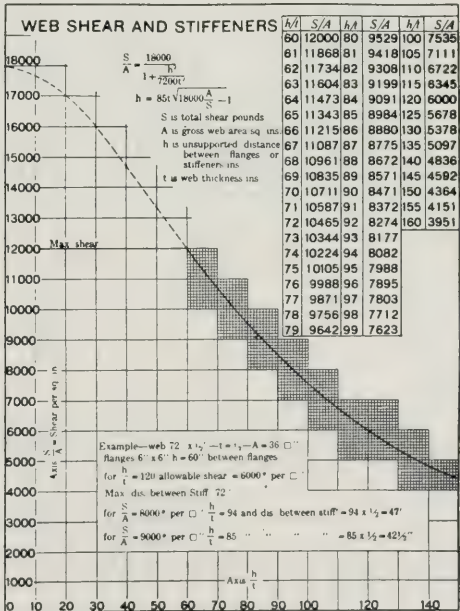
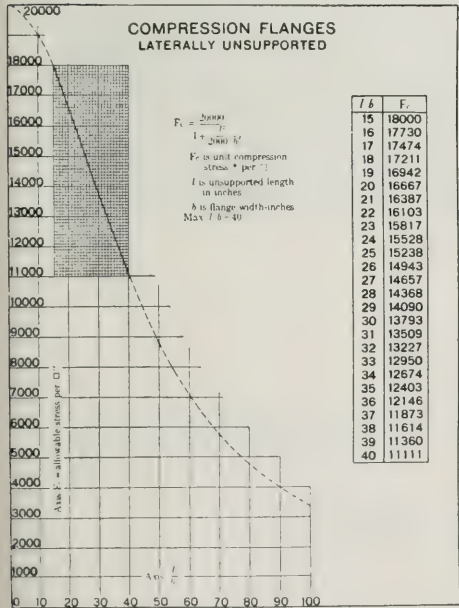
23. Inspection:

(a) Material and workmanship at all times shall be subject to the inspection of experienced engineers representing the purchaser.

(b) Material or workmanship not conforming to the provisions of this Specification shall be rejected at any time defects are found during the progress of the work.

(c) The Contractor furnishing such material or doing such work shall promptly replace the same.

(d) All inspection as far as possible shall be made at the place of manufacture, and the Contractor or Manufacturer shall co-operate with the Inspector, permitting access for inspection to all places where work is being done.

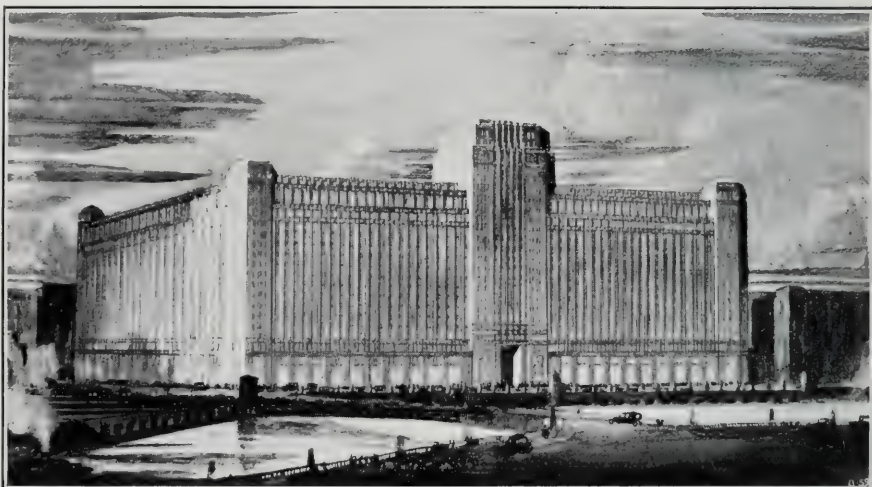


(Continued on page 399)

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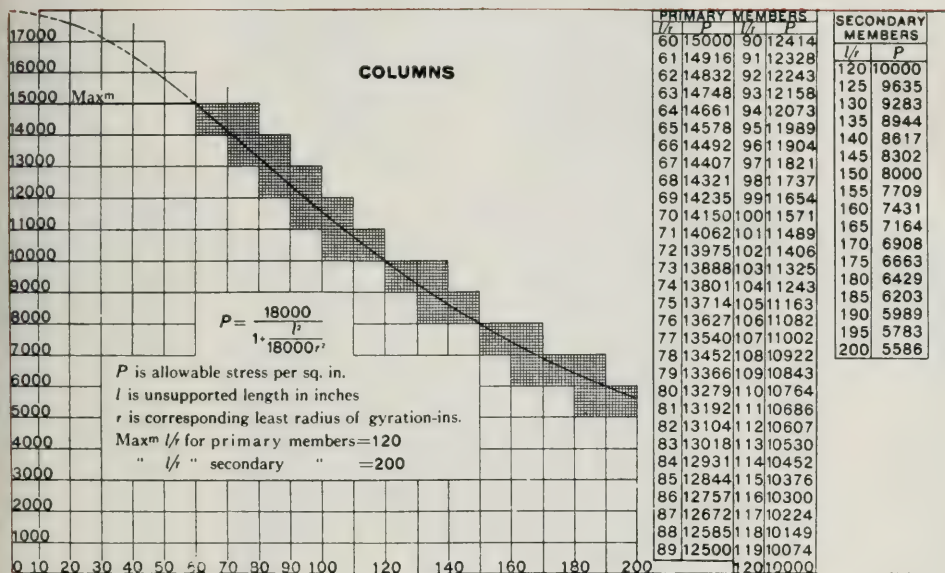


TABLE OF COMPARATIVE STEEL PRICES

1900—1930

YEAR	Local No. 2 Foundry Pig Iron at Chicago (at furnace). Per Gross Ton.			Composite Price of Finished Steel. National Average of Steel Bars, Beams, Tank Plates, Plain Wire, Open-hearth Rails, Black Pipe and Black Sheets. Quoted in cents per pound.			Steel Skeletons. Price per net Ton delivered at Chicago.		Structural Steel Beams at Chicago. Quoted in cents per pound.		
	High	Low	Average	High	Low	Average	High	Low	High	Low	Average
1914	\$14.25	\$12.56	\$13.60	1.477	1.366	1.434	\$ 48.60	\$37.26			
1915	18.10	12.95	14.01	1.941	1.383	1.534	59.00	34.10			
1916	29.50	18.13	20.26	3.278	2.060	2.671	94.00	63.80			
1917	55.00	30.00	41.31	5.334	3.384	4.188	105.00	95.00			
1918	34.00	33.00	33.25	3.550	3.461	3.542	119.00	91.00			
1919	38.75	26.75	29.16	3.371	3.004	3.115	110.00	79.00			
1920	46.00	34.50	42.53	3.967	3.114	3.675	122.60	92.00			
1921	31.50	19.00	22.93	3.057	2.107	2.532	83.60	48.00			
1922	32.00	18.90	24.85	2.461	2.007	2.220	90.00	46.00	\$2 20	\$1.53	\$1.86
1923	32.00	23.00	28.16	2.814	2.469	2.738	120.00	71.00	2.84	2.18	2.59
1924	24.50	19.60	22.10	2.783	2.464	2.609	89.00	67.50	2.60	2.00	2.33
1925	24.00	20.30	22.09	2.560	2.397	2.465	75.00	64.00	2.30	2.10	2.17
1926	23.00	21.00	21.64	2.453	2.416	2.439	79.00	65.00	2.10	2.10	2.10
1927	20.88	18.50	19.68	2.432	2.299	2.357	68.00	58.00	2.10	1.85	1.97
1928	20.00	17.60	18.54	2.385	2.318	2.352	67.00	57.00	2.00	1.91	1.99
1929	20.00	20.00	20.00	2.412	2.362	2.393	68.00	61.00	2.05	2.00	2.03
1930	20.00	17.50	18.47	2.325	2.124	2.209	63.00	55.00	1.99	1.70	1.81



Concrete Joist Floor Construction



The Trustees System
Building
Two-O-One
No. Wells St.
Chicago, Ill.
Architects:
Thielbar & Fugard
Engineer:
James B. Black
Contractors:
McLennan Construc-
tion Co.

Sets the Pace Anew

Essentially a reinforced concrete structure, the new Trustees System Building, Chicago, is the tallest of its kind ever constructed.

Significant is the fact that Concrete Joist Floor Construction was specified and Meyer Steelforms used for this important development in reinforced concrete design.

CONCRETE ENGINEERING COMPANY

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Chicago Warehouse Office—1926 S. 52nd Ave.

Telephone: Randolph 6877
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Other Offices and Warehouses: Omaha Detroit Milwaukee Minneapolis
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Also CECO REINFORCING AND FIREPROOFING MATERIALS

STANDARD SPECIFICATIONS FOR BILLET-STEEL CONCRETE REINFORCEMENT BARS

Serial Designation: A 15—14.

The specifications for this material are issued under the fixed designation A 15; the final number indicates the year of original issue, or in the case of revision, the year of last revision.

Adopted, 1911; Revised, 1912, 1913, 1914.

(1) (a) These specifications cover three classes of billet-steel concrete reinforcement bars, namely: plain, deformed, and cold-twisted.

(b) Plain and deformed bars are of three grades, namely: structural-steel, intermediate and hard.

2. (a) The structural-steel grade shall be used unless otherwise specified.

(b) If desired, cold-twisted bars may be purchased on the basis of tests of the hot-rolled bars before twisting, in which case such tests shall govern and shall conform to the requirements specified for plain bars of structural-steel grade.

I. Manufacture.

3. (a) The steel may be made by the Bessemer or the open-hearth process.

(b) The bars shall be rolled from new billets. No rerolled material will be accepted.

4. Cold-twisted bars shall be twisted cold with one complete twist in a length not over 12 times the thickness of the bar.

II. Chemical Properties and Tests.

5. The steel shall conform to the following requirements as to chemical composition:

Phosphorus

Bessemer.....not over 0.10 per cent

Open-hearth.... " " 0.05 "

6. An analysis to determine the percentages of carbon, manganese, phosphorus and sulfur, shall be made by the manufacturer from a test ingot taken during the pouring of each melt, a copy of which shall be given to the purchaser or his representative. This analysis shall conform to the requirements specified in Section 5.

7. Analysis may be made by the purchaser from finished bars representing each melt of open-hearth steel, and each melt, or lot of ten tons, of Bessemer steel, in which case an excess of 25 per cent above the requirements specified in Section 5 shall be allowed.

III. Physical Properties and Tests.

8. (a) The bars shall conform to the following requirements as to tensile properties:

Tensile Properties.

Properties Considered.	Plain Bars.			Deformed Bars.			Cold-twisted Bars.
	Structural-Steel Grade.	Intermediate Grade.	Hard Grade.	Structural-Steel Grade.	Intermediate Grade.	Hard Grade.	
Tensile strength, lb. per sq. in...	55,000 to 70,000	70,000 to 85,000	80,000 min.	55,000 to 70,000	70,000 to 85,000	80,000 min.	Recorded only.
Yield point, min., lb. per sq. in...	33,000	40,000	50,000	33,000	40,000	50,000	55,000
Elongation in 8 in. min., per cent..	1,400,000*	1,300,000*	1,200,000*	1,250,000*	1,125,000*	1,000,000*	5
	Tens. str.	Tens. str.	Tens. str.	Tens. str.	Tens. str.	Tens. str.	

(b) The yield point shall be determined by the drop of the beam of the testing machine.

9. (a) For plain and deformed bars over $\frac{1}{4}$ in. in thickness or diameter, a deduction of 1 from the percentages of elongation specified in Section 8 (a) shall be made for each increase of $\frac{1}{8}$ in. in thickness or diameter above $\frac{1}{4}$ in.

(b) For plain and deformed bars under $\frac{7}{16}$ in. in thickness or diameter, a deduction of 1 from the percentages of elongation specified in Section 8 (a) shall be made for each decrease of $\frac{1}{16}$ in. in thickness or diameter below $\frac{7}{16}$ in.

10. The test specimen shall bend cold around a pin without cracking on the outside of the bent portion, as follows:

Bend-Test Requirements.

Thickness or Diameter of Bar.	Plain Bars.			Deformed Bars.			Cold-twisted Bars.
	Structural-Steel Grade.	Intermediate Grade.	Hard Grade.	Structural-Steel Grade.	Intermediate Grade.	Hard Grade.	
Under $\frac{1}{4}$ in....	180 deg. d=t	180 deg. d=2t	180 deg. d=3t	180 deg. d=t	180 deg. d=3t	180 deg. d=4t	180 deg. d=2t
$\frac{1}{4}$ in. or over...	180 deg. d=t	90 deg. d=2t	90 deg. d=3t	90 deg. d=2t	90 deg. d=3t	90 deg. d=4t	180 deg. d=3t

Explanatory Note: d=the diameter of pin about which the specimen is bent;
t=the thickness or diameter of the specimen.

11. (a) Tension and bend test specimens for plain and deformed bars shall be taken from the finished bars, and shall be of the full thickness or diameter of bars as rolled; except that the specimens for deformed bars may be machined for a length of at least 9 in., if deemed necessary by the manufacturer to obtain uniform cross-section.

(b) Tension and bend test specimens for cold-twisted bars shall be taken from the

finished bars, without further treatment; except as specified in Section 2 (b).

12. (a) One tension and one bend test shall be made from each melt of open-hearth steel, and from each melt, or lot of ten tons, of Bessemer steel; except that if material from one melt differs $\frac{1}{8}$ in. or more in thickness or diameter, one tension and one bend test shall be made from both the thickest and the thinnest material rolled.

*See Section 9.

STEEL BARS FOR Reinforcing Concrete

PLAIN AND
DEFORMED
ROUNDS AND
SQUARES

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from Stock
and Mill
Rolling

OUR
SERVICE

ESTIMATING

SETTING AND
BENDING DETAILS

BENDING



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CHICAGO

(b) If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted.

(c) If the percentage of elongation of any tension test specimen is less than that specified in Section 8 (a) and any part of the fracture is outside the middle third of the gage length, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

IV. Permissible Variations in Weight.

13. The weight of any lot of bars shall not vary more than 5 per cent from the theoretical weight of that lot.

V. Finish.

14. The finished bars shall be free from injurious defects and shall have a workmanlike finish.

VI. Inspection and Rejection.

15. The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manu-

facture of the bars ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the bars are being furnished in accordance with these specifications. All tests (except check analyses) and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

16. (a) Unless otherwise specified, any rejection based on tests made in accordance with Section 7 shall be reported within five working days from the receipt of samples.

(b) Bars which show injurious defects subsequent to their acceptance at the manufacturer's works will be rejected, and the manufacturer shall be notified.

17. Samples tested in accordance with Section 7, which represent rejected bars, shall be preserved for two weeks from the date of the test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

STANDARD SPECIFICATIONS FOR RAIL STEEL CONCRETE REINFORCEMENT BARS

As Adopted by American Society for Testing Materials, Philadelphia, Pa., U. S. A., 1913.

Serial Designation A-16-14.

Classes.

1. These specifications cover three classes of rail-steel concrete reinforcement bars, namely: plain, deformed, and hot-twisted.

I. MANUFACTURE.

Process.

2. The bars shall be rolled from standard section Tee rails.

Hot-twisted Bars.

3. Hot-twisted bars shall have one complete twist in a length not over 12 times the thickness of the bar.

II. PHYSICAL PROPERTIES AND TESTS.

4. (a) The bars shall conform to the following minimum requirements as to tensile properties:

Properties Considered.	Plain Bars.	Deformed and Hot-twisted bars.
Tensile strength, lb. per sq. in....	80,000	80,000
Yield point, lb. per sq. in.....	50,000	50,000
Elongation in 8 in., per cent*.....	1,200,000 Tens. str.	1,000,000 Tens. str.

* See Section 5.

(b) The yield point shall be determined by the drop of the beam of the testing machine.

Modification in Elongation.

5. (a) For bars over $\frac{3}{4}$ in. in thickness or diameter, a deduction of 1 from the percentages of elongation specified in Section 4 (a) shall be made for each increase of $\frac{1}{4}$ in. in thickness or diameter above $\frac{3}{4}$ in.

(b) for bars under 7-16 in. in thickness or diameter, a deduction of 1 from the percentages of elongation specified in Section 4 (a) shall be made for each decrease of 1-16 in. in thickness or diameter below 7-16 in.

Bend Tests.

6. The test specimen shall bend cold around a pin without cracking on the outside of the bent portion, as follows:

Bend Test Requirements.

Thickness or Diameter of Bar.	Plain Bars.	Deformed and Hot-twisted bars.
Under $\frac{3}{4}$ in.....	180 deg. d = 3 t 90 deg.	180 deg. d = 4 t 90 deg.
$\frac{3}{4}$ in. or over.....	d = 3 t	d = 4 t

Explanatory Note: d = the diameter of pin about which the specimen is bent; t = the thickness or diameter of the specimen.

Test Specimens.

7. (a) Tension and bend test specimens for plain and deformed bars shall be taken from the finished bars, and shall be of the full thickness or diameter of bars as rolled; except that the specimens for deformed bars may be machined for a length of at least 9 in., if deemed necessary by the manufacturer to obtain uniform cross-section.

(b) Tension and bend test specimens for hot-twisted bars shall be taken from the finished bars, without further treatment.

Number of Tests.

8. (a) One tension and one bend test shall be made from each lot of ten tons or less of each size of bar rolled from rails varying not more than 10 lb. per yd. in nominal weight.

(b) If any test specimen shows defective machining or develops flaws, or if a tension test specimen breaks outside the middle third of the gage length, it may be discarded and another specimen substituted.

III. PERMISSIBLE VARIATIONS IN WEIGHT.

Permissible Variations.

9. The weight of any lot of bars shall not vary more than 5 per cent from the theoretical weight of that lot.



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AMERICAN INSTITUTE OF STEEL CONSTRUCTION

CODE OF PRACTICE

PREFACE.

Since the use of structural steel came into existence about thirty-five years ago, there has developed an industry engaged in the fabrication and erection of this material which at the present time is annually furnishing over \$300,000,000 worth of material to the public.

During this period of evolution it is obvious that many inconsistent practices should have come into existence, and the American Institute of Steel Construction, representing the industry between the rolling mills and the buying public, has undertaken the codifying of the various conditions, with a view of establishing uniform practice.

The Institute's Specification on the design, fabrication, and erection of structural steel has been received with widespread approval, and this Code of Standard Practice is now being issued to cover conditions not touched in the Specification.

(a) **Scope.** The rules and practices hereafter defined are adopted by the American Institute of Steel Construction as standard for the industry and shall govern all conditions where the contract between the buyer and seller does not specify otherwise and where they do not conflict with local or state requirements.

Section 1. Design.

(b) Unless otherwise specified or required, the design, fabrication and erection of structural steel shall conform to the Standard Specification of the American Institute of Steel Construction for buildings, dated June 1, 1923, or as amended to date.

Section 2. Classification.

(a) General.

The steel and iron items entering into the construction of a structure are divided into the following classes:

CLASS "A"—Structural Steel and Iron

CLASS "B"—Ornamental Steel and Iron

CLASS "C"—Steel Floor Joists

CLASS "D"—Miscellaneous Steel and Iron

In contracting to furnish the material for a structure where the material to be furnished is designated as structural steel and iron, ornamental steel and iron, steel floor joists, or miscellaneous steel and iron, the Seller will furnish only such items under each classification as are listed below, and no other items will be included unless by special understanding. In cases where materials in excess of minimum requirements are furnished to provide for waste or loss, all unused material remaining after completion of work shall be the property of the Seller and returned to him.

(b) Class "A" Structural Steel and Iron.

Contracts taken to furnish the structural steel and iron for a building are based on furnishing the following items only:

Anchors for structural steel only

Bases of steel or iron only

Beams of rolled structural steel

Bearing plates for structural steel

Brackets made of structural steel shapes

Channels of rolled structural steel

Channels and angle-supports only for suspended ceilings where they attach to structural steel but not including small channel or angle furring.

Columns, structural steel, cast iron and pipe

Girders of structural steel

Grillage, beams and girders (structural steel)

Hangers of structural steel

Lintels as shown or enumerated

Marquise (structural frame only)

Rivets and bolts for field connections, as follows:

1. The Seller shall furnish sufficient rivets of suitable size, plus at least 10% to cover waste for all field connections of steel to steel which are designated as riveted field connections.

2. The Seller shall furnish sufficient bolts of suitable size, plus 5% to cover waste for all field connections of steel to steel which are designated to be bolted unless specifically called for.

3. No fitting-up bolts or washers will be included.

Separators, angles, tees, clips, bracing and detail fittings in connection with structural steel frame.

Tie rods.

Trusses of structural steel.

Unless specifically agreed to in the contract, the Seller of the structural steel will not provide field connections or field holes for the ornamental steel and iron, the miscellaneous steel and iron, nor the materials for any other trades.

(c) Class "B" Ornamental Steel and Iron.

Contracts taken to furnish the ornamental steel and iron for a building are based on furnishing the following items only:

All Bronze and Brass work, except hardware fittings

Balconies

Cast Iron Cornices

Curtain Guides

Elevator fronts and enclosures

Grilles and gratings

Iron store fronts

Lamp standards and brackets

Marquise (steel or iron, except frame) see Class "A"

Ornamental brackets, steel or iron

Ornamental inside stairs, steel or iron

Ornamental outside steel or iron stairs, including fire escapes

Safety treads

Railings (gas pipes, ornamental or brass)

Sills and thresholds (brass, steel or iron)

Spiral stairs, steel or iron

Window sills and frames, steel or iron

Wire work, ornamental steel or iron

(d) Class "C"—Steel Floor Joists.

Contracts taken to furnish the steel floor joists for a building are based on furnishing the following items only:

Steel Joists which are not a part of the structural steel frame for the building, and which are devised to carry the floor or roof panels.

Bracing and bridging for floor joists; clips for fastening floor joists.

Stirrups and Hanger for Floor Joists.

Ties for floor joists.

(e) Class "D" Miscellaneous Steel and Iron.

The nature and character of the material of this classification makes it impossible to cover all items and it is recommended that the Seller taking the contract to furnish the miscellaneous steel and iron work for a building specify all items in detail which



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Incorporated 1913

it is intended to furnish. The general list of items under this classification is as follows:

Area gratings
Cast iron cover and frames
Cast iron rainwater receivers
Cast iron downspout shoes
Cleanouts
Coal chutes
Column guards
Door frames and bucks
Foot scrapers
Furnace or fireplace dampers
Flag pole
Ladders
Pin rails
Sidewalk doors
Sills and curb angles, and anchors for same
Special bolts or anchors where distinctly shown on the plans
Stairs made of plain structural steel—not including treads of other materials
Stacks
Steel and cast iron platforms
Steel or iron chimney caps
Thimbles
Wall plate anchors
Wheel guards
Window guards
Wire screens for partitions, door and window guards (this does not include fly screens)

(f) Materials Not Classed Under the Above Headings.

The following items are not covered by classifications A, B, C, and D, and will in no case be furnished by the Seller unless specifically agreed to and mentioned in the contract. It is not possible to designate every detail, and the list is typical of material not included in classification A, B, C, and D. It is shown here to assist the Architect and Engineer in avoiding confusion:

Ash hoists
Awning boxes
Boilers
Elevators or accessories
Elevator guides or sheave beams
Expanded metal
Furring
Glass for any purpose whatever
Hollow metal doors or frames
Hoppers
Mail chutes
Metal lockers
Miscellaneous carpenter or masonry bolts for connecting wood to wood, steel to wood, or wood to stone, etc.
Name plates
Patented devices
Pilot and driving nuts
Reinforcing steel
Rolling doors
Sheet metal work or corrugated sidings and roofing
Sidewalk lights
Steel sash and steel sash partitions
Spiral slides
Suspended ceiling, except as noted under Class "A"
Tanks and pans
Toilet partitions
Treads, except steel or iron
Vault doors
Ventilating brick

Wall, ceiling and floor registers
Wood handrails
Wood handrail brackets
And all other material not mentioned.

Section 3. Invoicing.

When conditions make it possible to award contracts on a lump sum basis, the confusion of determining weights will be avoided. Scale weights involve a variation which frequently lead to a compromise based on calculated weights.

The rules hereafter established, while not giving exact weights, are the basis upon which the Seller must make a lump sum or a pound price bid, and they eliminate the necessity of increased cost of shop drawings and other refinements of manufacture which would very materially increase costs if exact weights were required.

(a) **Weights:** Structural steel and iron sold at a unit price per pound, hundred weight (100 lbs.) or ton (2,000 lbs.) shall be invoiced on the calculated weights of shapes, plates, bars, castings, rivets and bolts, based on the detailed shop drawings and shop bills as follows:

1. **Dimensions:** The weight will be figured on the basis of rectangular dimensions for all plates, and overall dimensions for all structural shapes, and with no deductions for copes, clips, sheared edges, punchings, borings, milling or planing. When plates can be economically cut in multiples out of one large rectangular plate, then the calculated weight of the plates shall be determined by the area of the large plate

2. **Over-run.**

(a) To the nominal theoretical weights of all sheared plates will be added one-half the allowance for overrun in weights in accordance with the Specifications of the American Society for Testing Materials.

(See tables in A. S. T. M. Specifications).

(b) Reinforcing bars when not sold on a basis of scale weights shall be invoiced by the Seller at the theoretical weight plus 1½% to allow for overrun weight of deformations, etc.

(c) To the theoretical weight of all castings shall be added 10% to cover average overrun.

3. **Rivets.**

(a) The weight of shop rivets will be based on the weights shown in the following table:

	Per 100 Rivets
1. Rivets ¼" in diameter.....	20 lbs.
2. Rivets ⅝" in diameter.....	30 lbs.
3. Rivets ¾" in diameter.....	50 lbs.
4. Rivets 7⁄8" in diameter.....	100 lbs.
5. Rivets 1" in diameter.....	150 lbs.
6. Rivets 1½" in diameter.....	250 lbs.
7. Rivets 1¾" in diameter.....	325 lbs.

(b) Field rivets and bolts shall be invoiced at their actual weight.

4. **Paint:** One-half of 1% of the theoretical weights of the material painted will be added for each coat of shop paint. For work oiled, one-fourth of 1% for each coat will be added.

Section 4. Drawings and Specifications.

(a) The Buyer shall furnish the Seller within a time agreed to in the contract a survey of the lot lines, together with a complete and full design of the structural steel frame definitely locating all openings, levels, etc., and showing all material to be furnished by the Seller with such information as may be necessary for the completion of the shop drawings by the Seller. All such information and drawings shall be consistent with the original drawings and specifications.

(b) In cases of discrepancies between the drawings and the specifications prepared by either the Seller or the Buyer, the



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Aluminum

Bronze

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Ornamental Iron

Steel Stairs

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CHICAGO, ILL.

specifications shall govern; and in case of discrepancies between the scaled dimensions on the drawings and the figures written on them, the figures shall govern. Should the Seller in the execution of his work find discrepancies in information furnished by the Buyer, he shall refer such discrepancies to the Buyer before proceeding further with work which would be affected.

(c) Shop Drawings shall be made and submitted to the representative of the Buyer, who shall examine the same and return them approved with such corrections as he finds necessary. They shall be corrected by the Seller if necessary and returned for the Buyer's file as finally approved. The Seller may proceed with shop work, but in so doing, he shall assume responsibility for having properly made the corrections indicated by the Buyer.

(d) Shop Drawings prepared by the Seller and approved by a representative of the Buyer shall be deemed the correct interpretation of the work to be done, but does not relieve the Seller of responsibility for the accuracy of details.

(e) After the plans and shop drawings have been "approved" or "approved as noted" by the authority designated in the contract, any further changes required shall be made at the expense of the Buyer.

(f) When detailed shop drawings are furnished by the Buyer no responsibility for misfits due to errors in the drawings will be assumed by the Seller.

Section 5. Good Workmanship and Standard Practice.

Good workmanship and standard practice in a modern structural shop is defined as follows:

(a) **Material:** Stock material shall be of a quality substantially equal to that called for by the specifications of the American Society for Testing Material for the classification covering its intended use; and mill test reports shall constitute sufficient record as to the quality of material carried in stock. It is obviously impossible for the Seller to maintain records of heat or blow numbers of every piece of material in his stock, and the same shall not be required if all his stock purchases are made under an established specification as to grade and quality.

Whenever a shop maintains such a practice in carrying a stock of material, it is deemed good practice to permit the use of such stock material in its fabricating operations whenever the shop desires to do so, instead of ordering items from the mill for a specific operation. Stock materials bought under no particular specifications, or under specifications materially less rigid than those mentioned above, or stock material which has not been subject to mill or other recognized test reports, shall not be used, except as noted below, without the approval of the Buyer and under rigid inspection.

It is permitted to use unidentified stock material free from surface imperfections for short sections of minor importance or for small unimportant details, where the quality of the material could not affect the strength of the structure.

(b) **Straightening:** All material shall be straight, and if straightening or flattening is necessary, it shall be done by a process that will not injure the material. Sharp kinks or bends shall be cause for rejection.

(c) **Punching:** The punch shall be $\frac{1}{16}$ " larger than the nominal diameter of the rivet, and the die opening not more than $\frac{1}{16}$ " larger than the diameter of the punch. The thickness of the material in punched work shall not be greater than nominal diameter of the rivet, plus $\frac{1}{16}$ ". The accuracy of the punching shall be such that for any group of holes when assembled, 75% shall admit a rod equal to the diam-

eter of the cold rivet at right angles to the plane of the connection, otherwise the holes shall be reamed.

Likewise, when work is assembled, all holes which will not admit a rod $\frac{1}{16}$ " smaller than the nominal diameter of the cold rivet shall be reamed.

(d) **Reaming:** Reamed or drilled holes shall not be required unless specifically agreed to in the contract. When specifications require that work shall be sub-punched and reamed, the die used for punching shall be $\frac{1}{16}$ " smaller than the nominal diameter of the rivet, and the assembled holes shall be reamed to a diameter of $\frac{1}{16}$ " larger than the nominal diameter of the rivet.

(e) **Planing:** Planing or finishing of sheared plates or shapes will not be required unless specifically called for by the specifications or drawings.

(f) **Assembling:** All parts of riveted members shall be well pinned or bolted and rigidly held together while riveting. Drifting done during assembling shall not distort the metal to enlarge the hole on the side on which the die was used in punching.

Finished members shall be true to line and free from twists, bends and open joints. It is not the function of fitting up bolts to bring improperly straightened material into place, thus causing a strain on the rivets in the finished work.

Compression members shall not have a lateral variation greater than 1 to 1000 of the axial length between the points which are to be laterally supported.

An allowable variation of $\frac{1}{8}$ " is permissible in the overall length of members with both ends milled.

Members without milled ends which are to be assembled to other steel parts of the structure shall not have an error greater than $\frac{1}{8}$ " for members 30 feet or less in length, and not more than $\frac{1}{4}$ " for members over 30 feet in length.

(g) **Riveting:** Rivets shall be heated uniformly to a light cherry red, and shall be driven and the heads formed with a proper sized die while hot. When heated and ready for driving, rivets shall be free from slag scale, and carbon deposits. When driven they shall completely fill the holes.

Loose, burned or otherwise defective rivets shall be replaced. After driving, the rivet heads, shall be full, neatly made, concentric with the rivet hole, and in full contact with the surface of the member. Caulking the rivet head shall not be permitted.

(h) **Burning Torch:** The use of a burning torch is permissible if the burned metal is not carrying stresses during the burning. Stresses shall not be transmitted into the metal through a burned surface.

The material adjacent to a burned surface for a distance equal to the thickness of the material shall not be considered a part of the net section for tension members.

Section 6. Inspection and Delivery.

(a) **Inspection:** The Seller's shop service includes inspection by his own inspectors, and shop or mill inspection other than this shall be paid for by the Buyer, except when otherwise called for in the specification.

(b) **Acceptance of Materials:** When material is inspected by a representative of the Buyer at the shop, the acceptance of such material by the Buyer's representative shall be considered the Buyer's final approval, but the Seller shall be responsible for the accuracy of the work and for defective material or workmanship which may be discovered before the completion of the structure.

(c) **Order of Delivery:** Unless the order or sequence of delivery is specifically arranged for before the work is undertaken, it will be at the convenience of the Seller.

(d) **Materials Sold Delivered.** When material is sold delivered on cars or trucks

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at the site of the structure, all unloading shall be done by the Buyer, and all responsibility to persons or property during such unloading shall be at the Buyer's risk.

(e) **Loss in Shipment where Material Is Sold Fabricated Only:** The quantity of material shown by the shipping statements will in all cases govern settlements unless notice of shortage is immediately reported to the agent of the delivering carrier, and his signed verification obtained, and like notice sent to the Seller within 48 hours after receipt of the shipment, in order that the alleged shortage may be investigated by the Seller.

(f) **Storage of Material:** Where conditions make it necessary that material be stored for any length of time, and the contract does not provide for such storage, payments are to come due and be payable the same as if the material had been delivered at the building site; and the Seller shall be compensated for handling storage, and other increased expenses as may result from such conditions.

Section 7. Erection.

(a) **Foundations:** The Seller or Erector shall not be responsible for the strength or suitability of the foundations.

(b) **Building Lines and Bench Marks:** Building Lines and Bench Marks at the site of the structure shall be accurately located by the Buyer, and carefully shown or described by him or his representative to the steel erector or his engineer.

(c) **Steel or Cast Iron Bases.** All steel grillage, slabs, or cast iron bases in bridge or building work shall be set to grade and line by the Buyer unless otherwise specifically agreed upon.

(d) **Anchor Bolts.** All anchor or foundation bolts shall be set by the Buyer.

(e) **Working Room:** The erection contractor shall be entitled to sufficient space at the site of the structure in a place convenient to him to place his derrick and other necessary erection equipment. When conditions at the site permit, he shall be entitled to storage space for enough material to keep his erection force in continuous operation.

(f) **Plumbing Up:** The temporary guys and braces shall be the property of the Seller, and if, after the steel has been plumbed and leveled, the work of completing the structure by other contractors is suspended or delayed, the owner of the temporary guys and braces shall receive reasonable compensation for their use. The guys shall be removed by the Buyer at his expense and returned to the Seller in as good condition as when placed in the building with a reasonable depreciation.

Immediately upon completion by the steel erector, the Buyer shall assure himself by whatever agencies he may elect, that the steel erector's work is plumb and level, and properly guyed. If it is not, he should immediately notify the erector and direct him to perfect his work. After the steel erector has guyed and plumbed the work once to the satisfaction of the Buyer, his responsibility ceases. Any further work in guying or plumbing shall be performed entirely at the Buyer's expense.

In the setting or erecting of structural steel work, the individual pieces shall be considered plumb or level where the error does not exceed 1 to 500.

For exterior columns and columns adjacent to elevator shafts of multiple story buildings, the error from plumb shall not exceed 1 to 1000 for the total height of the column.

(g) **Opportunity to Investigate Errors:** Correction of minor misfits and a reasonable amount of reaming and cutting of excess stock from rivets will be considered as a legitimate part of erection. Any error in shop work which prevents the proper as-

sembling and fitting up of parts by the moderate use of drift pins, or a moderate amount of reaming and slight chipping or cutting, shall immediately be reported to the Seller and his approval of the method of correction obtained.

(h) **Wall Plates:** All loose masonry bearing plates for beams, lintels, trusses or columns shall be set to grade and line by the Buyer ready for the steel erector to set his work.

(i) **Loose Lintels:** Loose Lintels or pieces of all kinds and descriptions required by the design of a building to carry brick work over openings, and which lintels or pieces are not attached in any way to the rest of the steel structure, and cannot be placed except as the masonry work advances, will not be erected by the steel erector unless by special agreement.

(j) **Ornamental Iron and Bronze:** Fine ornamental iron and bronze work is considered as finishing material, and shall not be set in a building until after the marble, plaster, and other work, except decorating, is in place.

(k) **Elevator Framing:** The setting or erection of guides, cars, machinery, cables, sheaves, pans, etc., for elevators, is not to be required of the steel erector.

(l) **Field Assembling:** The size of assembled pieces of structural steel is fixed by the permissible weight and clearance dimensions of transportation. Unless such conditions are provided for by the Buyer or his engineer, the Seller shall provide for such field connections as will require the least field work; and such field connections shall be a part of the erection work.

(m) **Cutting and Patching:** The Seller shall not be required to cut or patch any work, except his own, unless particularly specified, and will not alter his own work required by changes or inaccuracies in the building without being reimbursed for the expense of such changes.

(n) **Insurance:** The erector shall indemnify and save harmless the Buyer from all claims and costs arising from any damage to person or property occurring in the performance of his own work due to any act or neglect of his employees or agents.

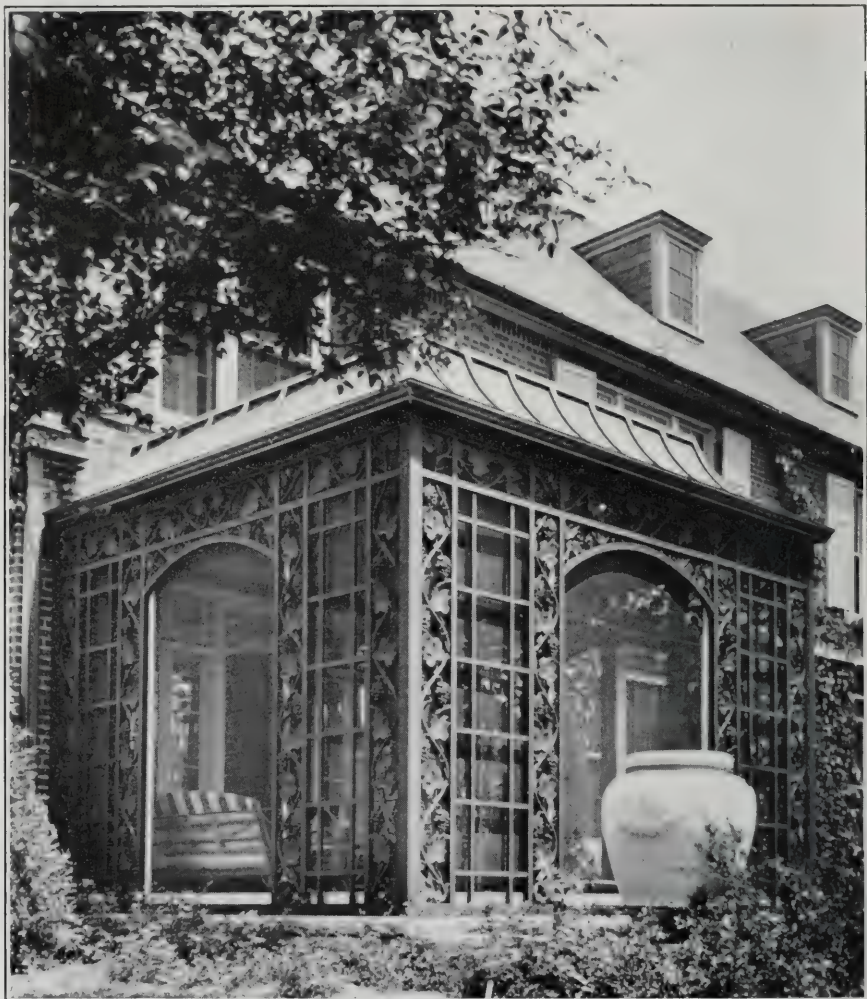
(o) **Temporary Floors:** The Buyer shall provide plank, and cover all floors required by municipal or state laws, excepting the floor upon which the erecting derricks are located. This floor will be provided by the steel erector for working purposes.

(p) **Field Paint:** Unless specifically agreed to in the contract, field paint shall be considered a phase of maintenance, and such protection as is necessary shall be provided for by the Buyer.

Section 8. Delays in Prosecution of Work.

(a) **Causes Not Controlled by Seller nor Buyer:** Neither Seller nor Buyer shall be responsible for delays in performance caused by delays at rolling mills, or in transportation, or due to strikes, fires, floods, storms, or any other circumstances beyond their reasonable control, whether related or unrelated, or similar or dissimilar to any of the foregoing. In case of delay to work due to any of the above causes, a reasonable extension of time shall be given for the completion of the work.

(b) **Delays Caused by the Seller:** Should the Seller at any time, except as provided in the preceding paragraphs, refuse or neglect to supply enough workmen of proper skill or material of proper quality, or to carry on the work with promptness and diligence, the Buyer, if not at fault, may give the Seller ten days' written notice, and at the end of that time if the Seller continues to neglect the work, the Buyer may provide such labor or materials and deduct the cost from any money due or to become due the Seller under the contract, or may terminate the employ-



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ment of the Seller under this agreement and take possession of the premises and of all materials, tools, and appliances thereon and employ any other person to finish the work. In the latter case, the Seller shall receive no further payment until the work be finished; then if the unpaid balance that would be due under the contract exceeds the cost to the Buyer of finishing the work, such excess shall be paid to the Seller but if such cost exceeds such unpaid balance, the Seller shall pay the excess to the Buyer.

(c) **Delays Caused by the Buyer:** The Buyer shall be responsible for delays resulting from lack of complete data and from changes or revisions or the tardy approval of drawings. Information given later than the date fixed in the contract for the delivery of complete information shall not be cause for a claim by the Seller unless such delay affects Seller's costs or manufacturing operations. When such delays increase costs or compel changes in the Seller's manufacturing operations he shall be recompensed for the damage resulting.

If information is available for the Seller to manufacture or erect the material in accordance with the conditions of the contract and if he is prevented from the orderly and continuous prosecution of such work by any act or a neglect of the Buyer, the Seller may continue his work and may place fabricated material in storage at his own plant or elsewhere and the Buyer shall, upon tender of transfer of title, pay for said material as if it had been delivered under the terms of the contract. The Buyer shall also recompense the Seller for all expense incurred in the storing, caring for, or rehandling of said material; and for damage resulting from changed manufacturing operations. On erection work the Seller shall be recompensed for any extra expense incurred in wages and in the transportation of men or equipment to and from the site and their maintenance at the site during the period of delay, also for extra expense resulting from overtime made necessary by such delay.

If for more than one month at any time, any act or neglect of the Buyer or any legal proceeding taken against him, prevents the starting or continuous prosecution of the work, the Seller may give the Buyer ten days' written notice, and at the end of that time, if the Buyer continues at fault or the legal proceeding continues effective, the Seller may terminate his obligations under the contract; in which case the Buyer shall at once pay the Seller for the work done and material provided, and all damages the Seller may sustain, including damages resulting from changed shop operations.

Section 9. Extra Work.

(a) **General:** Charges for extra work, or work not covered by the contract, shall be made on a basis that is definitely and mutually understood between the Buyer and the Seller at the time the occasion for such extra expense arises.

In the absence of such an understanding between the Buyer and the Seller, the following is listed as proper expenses.

(b) **Material:** All extra material required shall be invoiced out at current warehouse prices, plus cost of fabrication, including regular overhead costs, plus transportation costs, and an agreed percent for profit.

(c) **Drafting Labor:** All extra labor in the drafting room shall be invoiced out at cost, plus overhead, plus an agreed percent for profit.

(d) **Shop Work:** All extra shop labor shall be charged at actual cost as shown by the time cards; to this shall be added the overhead expense, and the use of equipment and power. The sum of these charges shall be considered the actual cost of the shop, to which shall be added an agreed percent for profit.

(e) **Field Work:** All extra labor required in the erection of structural steel shall be invoiced as follows:

The actual labor cost shall be that shown by the time cards, to which shall be added the actual cost of insurance, the cost of labor transportation when necessary, and an additional allowance for overhead expense. The sum of these shall be considered the actual cost, to which shall be added an agreed percent for profit.

Should the Buyer or his agent or other trades engaged in the erection of other work connected with the structure require the use of materials or equipment belonging to the Seller, the Seller shall receive compensation for such extra service together with depreciation of equipment and an agreed percent for profit.

(f) **Miscellaneous:** Any additional cost, such as hauling, painting, crating, freight, etc., shall be charged at actual cost, plus overhead, plus insurance, plus an agreed percent for profit.

(g) **Overtime:** On contract work where the Seller has not agreed to work overtime, he shall not be required to do so without being paid for his extra expense and a profit.

(h) **Extra Cleaning:** If because of continued storage, or for any other reason not the fault of the Seller, it should be necessary to clean and repaint the steel work, the cost of this additional cleaning and painting should be paid for as an extra, including regular overhead charges as specified for extra work elsewhere in this section.

Section 10. Proposals and Contracts.

(a) **Direct Contracts:** It is recommended that in all cases where the structural steel frame of a building is self supporting, and also in all such other cases where the structural steel and iron items entering into the construction of a building can easily be separated from the other materials of construction, that all contracts for such structural steel or iron be made separately by the owner or his representative with the steel contractor.

(b) **Conflicts:** In the event of a conflict between the terms and conditions of the proposal, and the terms and conditions stated in the plans and specifications, the terms of the proposal shall govern.

(c) **Price for Additions or Deductions:** The Seller is not to be required nor expected to make the same unit price for additions to as for deductions from the list of material required for a structure. The contract may, however, specify a certain other unit price for such materials as may be deducted from the quantity of material as originally contemplated by the contract.

(d) **Material not Shown or Called for:** Clauses in the specification to the effect that all iron and steel items necessary to complete the structure shall be furnished by the Seller, whether or not they are shown on the plans or called for in the specifications, being obviously unfair, will not be recognized or subscribed to. The Seller shall, however,

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Simple and substantial in construction, durable in finish, and of high artistic merit.

For buildings where considerable volume of mail originates, two or more Mail Chutes are provided, usually installed in pairs, as illustrated. By opening the chutes on alternate floors, danger of over-crowding is avoided, and in case of need one chute can be cleared, cleaned, or repaired, while the service is maintained by the other without interruption.

The Standard Mail Box is now furnished in various architectural styles and finishes.

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furnish all material and labor for details that may be required for such steel and iron work as is shown on the drawings or called for in the specification, although such details may themselves not be shown or called for.

(e) **Items not to be Furnished:** Unless specifically mentioned in the request for bids, or specifically agreed to, the bidders do not estimate or include the following items in their proposals:

Any charges for surety bonds or insurance not required by law, or any other general charge such as building permits, license fees or taxes for permission to work in city or state, engineering fees, removal of rubbish, patching or repairing of plaster or masonry work, office or telephone service, light heat, fire insurance, or the erection of temporary structures, enclosures, or stairs.

(f) **Terms:** The following terms of payment are adopted as standard and will govern in all cases, except when otherwise agreed to in the contract.

1. All payments shall be made in funds current at par in the city in which the Seller furnishing the material is located.

2. All materials for export, net cash in exchange for shipping documents will be required.

3. For all materials to be erected by the Seller the Buyer shall on the 10th day of each month pay an amount equal to not less than 90% of the contract value of all ma-

terials shipped, stored or ready for shipment; and not less than 90% of the contract value of the erection performed during the preceding month; and shall pay the remainder within 10 days after the completion of the steel contract; but the amount reserved by the Buyer shall at no time exceed double the contract value of the work remaining yet to be done.

4. When the material which is not to be erected by the Seller is sold to a Buyer whose credit has been established with the Seller, terms net cash for contract value of each shipment. Payments to be made on the 10th day of the month following shipments.

5. Unless otherwise agreed to when material is sold delivered at, or freight allowed to destination, the Buyer shall pay freight charges and the Seller shall accept receipted freight bills as cash to apply on matured payments due on or after arrival at destination of materials covered by such freight expense bills.

6. Payments shall all be considered to be due and shall be paid at the time specified, regardless of the final settlement for the building as a whole, or for the work of any other trade; and when the contract is with a general contractor the payment for steel shall not be delayed by such general contractor pending his receiving estimates of payments from the owner.

7. Amounts past due shall bear interest at the maximum lawful rate.

MAILING CHUTE RULES, REGULATIONS, AND SPECIFICATIONS OF THE POST OFFICE DEPARTMENT

(See Section 696, Postal Laws and Regulations.) The law provides as follows: * * * The postmaster General is hereby authorized, in his discretion, to declare by official order that the chutes connected with mail boxes that are attached to any chute or device which may be approved by him are a part of said receiving boxes and under the exclusive care and custody of the Post Office Department.

Types of Buildings.—1. Mailing chutes and receiving boxes may be placed, subject to the approval of the postmaster, in public buildings, railroad stations, hotels of not less than five stories in height, business or office buildings of not less than four stories in height, and apartment houses comprising not less than 50 residential apartments. Buildings in which receiving boxes are or may be located shall be open to the general public, without restriction, at all times during the hours prescribed for mail collections, in order to afford access to such receiving boxes for the deposit of mail matter therein.

Procedure for Approval.—2. The postmaster is vested with authority to approve the installation, for collection purposes, of mailing chutes and receiving boxes conforming to these regulations. To him shall be sub-

mitted the contract and specifications for any proposed chute and box, with a tentative plan of the building showing the contemplated location therein of the whole of such chute and of the box connected therewith. If the postmaster approve such contract and specifications and the location proposed, he shall indorse his approval upon such contract and make report of his action to the Post Office Department. Collection shall not be made from any chute not so approved, and such unapproved chute shall not bear any sign or insignia indicating that it is under the jurisdiction and protection of the United States Postal Service.

Distance of Receiving Box from Entrance.—

3. Every receiving box shall be placed as near to a main entrance of the building as may be practicable, provided that in no case shall such receiving box be located more than 100 feet from a main entrance, by the shortest line of travel. Where, after careful examination of the tentative building plan, the postmaster finds it impracticable because of structural conditions to place such receiving box within 50 feet or less of a main entrance, he may approve a location in excess of that distance, provided it is no farther from such main entrance than the center of the ground floor of the building,

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Fidelity Philadelphia Trust.....	Chicago Daily News..... Chicago
..... Philadelphia	Civic Opera House..... Chicago
Municipal Building Philadelphia	Medinah Athletic Club..... Chicago
Bamberger Store Newark	Palm Olive Building..... Chicago
Keith Memorial Theatre..... Boston	Insurance Exchange Chicago
Koppers Building Pittsburgh	Pittsfield Building Chicago
Kaufman Store Pittsburgh	Foreman National Bank..... Chicago
Convention Hall..... Atlantic City	Merchandise Mart Chicago
Terminal Tower Cleveland	Passavant Memorial Hospital Chicago
Medical Arts & Builders Exchange..	Chicago Motor Club..... Chicago
..... Cleveland	Shedd Aquarium Chicago
First National Bank..... Detroit	R. R. Donnelley Building..... Chicago
Fox Theatre Detroit	McGraw-Hill Building Chicago
Fox Theatre St. Louis	Chicago Club Chicago
American Bank..... New Orleans	Steuben Club Chicago
Dade County Court House... Florida	124th Field Artillery Armory.. Chicago
Foshay Tower Minneapolis	Studebaker-Pierce Arrow Show Rooms Chicago
North Western National Bank.....	Marshall Field Store..... Oak Park
..... Minneapolis	Marshall Field Store..... Evanston

that it is within the maximum of 100 feet. In no case shall a receiving box be placed on other than the ground floor of a building.

Construction and Installation of Chutes.—4. Every mailing chute shall be made wholly of metal and glass, and so constructed that all portions of its interior may be easily reached by postal authorities, but not by other persons. It shall extend in a continuously vertical line from the point of beginning to the receiving box, and be so placed as to be conveniently accessible throughout its entire length. In no case shall a mailing chute be placed behind an elevator screen or partition, or run through any part of a building to which the public is denied access. At least three-fourths of the front of the chute in each story shall be of plate-glass, not less than one-fourth of an inch in thickness where exposed, and the metal parts of the chute shall be of such weight and character as to insure rigidity, safety, and durability. The openings of every chute shall be of such form and dimensions as to prevent the reception of bulky parcels or newspapers, such as may crowd or clog the chute. Such openings shall be provided with some suitable device by means of which they may be opened and closed by postal authorities, but not by other persons. The legend "U. S. Mail" shall be plainly inscribed upon chutes at every mail opening.

Construction and Installation of Receiving Boxes.—5. Such receiving boxes shall be constructed of metal of sufficient weight and such character as to insure security and rigidity, and be provided with doors opening upon side hinges secured by rivets. The cubic contents of each such box shall be determined by the postmaster. The floor of the interior of the box, or cushion if one be used, shall be level with the threshold of the door; and the bottom of the door shall be in no case less than 30 inches from the floor level of the building. The distance from the exterior of the bottom of the box (including all ornamentation) to the floor level of the building shall be not less than 20 inches, and this space shall be entirely open and unobstructed. Every such receiving box shall be provided with an elastic cushion, yielding bottom, or deflecting device, effectively to prevent injury to mail matter descending through the chute. Such boxes shall be so arranged that the mail collector may place a satchel or other receptacle in convenient position under the bottom of the door when making collections and be provided with suitable means of attaching and holding the satchel or other receptacle in position. Receiving boxes shall be distinctly and legibly marked "U. S. Mail Letter Box," and shall each be supplied with a street letter-box lock.

Inspection and Maintenance.—6. Any obstruction in a mailing chute may be at once reported to the postmaster, who shall promptly make an inspection of the chute. If he finds such obstruction to have resulted from misuse or abuse of the chute, he shall so notify the proprietor or lessee of the building in which the same is located, and may, in his discretion, close the mail openings and discontinue collections from such chute until satisfied that proper care will be exercised in its future use and in the use of the receiving box connected therewith. Upon so discontinuing collections the postmaster shall attach to the chute, at the several mail openings, notices of such discontinuance. Should any part of such chute or receiving box be found by the postmaster to be not in conformity with these regulations, or to have become defective, he shall close the mail openings therein and discontinue collections therefrom, and shall not resume such collections until such mailing chute and receiving box shall have been made fully to meet the requirements of these regulations. All repairs, changes, and alterations to mailing chutes and receiving boxes shall be made by and at the expense of the

owner or lessee of the building in which they are situated, under the supervision and subject to the approval of the postmaster.

7. Every mailing chute and receiving box shall be inspected by a representative of the postmaster at least once in each year; and such cleaning and repairing as shall be directed by the postmaster shall be then done under his supervision, by and at the expense of the proprietor or lessee of the building in which such mailing chute and receiving box are situated.

For First-Class Mail Only.—8. Mailing chutes and receiving boxes are intended for the reception or deposit of mail matter of the first class, and must not be otherwise so used as to reduce their efficiency for this purpose or to retard the handling of such first-class matter.

Custody and Control.—9. Mailing chutes and receiving boxes shall be considered the property of the United States whenever and so long as collections of mail matter are made therefrom, and shall be and remain under the exclusive custody and control of the postmaster until such collections are discontinued by his direction.

Waiver of Claims and Bond.—10. Every mail-chute contract shall contain an explicit waiver by the owner or owners of patents issued and to be issued upon the chute and receiving box, or either of them, covered by such contract, and upon any device or devices connected therewith, of all claims against the United States and its officers and agents on account of the use or employment of such chute and box and such device or devices, and shall also contain a full warranty by the company or person proposing to erect such chute and receiving box against claims on account of infringements of the patents of others. Before commencing collections of mails the postmaster shall also require such person or company to file with him a waiver of all claims of every name and nature arising under the contract, with a bond in such form and with such penalty as shall be prescribed by the Postmaster General, conditioned that the obligor and his or its sureties shall and will protect and indemnify the United States from any and all such claims, accompanied with a written notice from such person or company that they have no claim of any kind against such mailing chute and receiving box or either of them.

Agreement for Removal of Chutes.—11. When mailing chutes and receiving boxes are erected under lease, the postmaster is authorized to sign an agreement, indorsed on the back of the contract, between the proprietor or lessee of the building and the person or company erecting such chutes and boxes, providing that if the lessors of such chutes and boxes shall request the discontinuance of mail collections therefrom and the return of the mailing apparatus to them, the postmaster will, after due notice to such proprietor or lessee, discontinue such collections, remove the lock from the receiving box, and permit the removal of the mailing apparatus by said lessors.

Instruction Cards and Frames Therefor.—12. Printed cards, properly framed and glazed and giving information as to the use of mailing chutes and receiving boxes and the hours of collection therefrom, shall be attached at each mail opening, and every chute and receiving box shall be furnished with a suitable and convenient glazed frame for such cards.

These Regulations to Form a Part of Every Contract for Chutes.—13. These regulations shall be printed on the back and become a part of every contract hereafter entered into between manufacturers or owners of mailing chutes and receiving boxes for the erection and use of such chutes and boxes and the proprietor or lessee of the building in which they are located.

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SPECIFICATIONS FOR PLAIN AND REINFORCED CONCRETE

WATER-CEMENT RATIO METHOD.

These specifications are based on the Proposed Standard Building Regulations submitted by Committee 501 of the American Concrete Institute. Where the conditions of exposure or watertightness are governing factors, water-cement ratios should be selected which will produce the desired quality even if the resulting strengths are higher than required for the design.

MATERIALS.

1. Portland Cement.

(a) Portland cement shall conform to the "Standard Specifications and Tests for Portland Cement" (Serial Designation: C9-26) of the American Society for Testing Materials.

2. Concrete Aggregates.

(a) Concrete aggregates shall consist of natural sands and gravels, crushed rock, crushed air-cooled blast furnace slag, or other inert materials having clean, uncoated grains of strong and durable minerals. Aggregates containing soft, friable, thin, flaky, elongated, or laminated particles totaling more than 3 per cent, or containing shale in excess of 1½ per cent, or silt and crusher dust finer than the No. 100 standard sieve in excess of 2 per cent shall not be used. These percentages shall be based on the weight of the combined aggregate as used in the concrete. When all three groups of these deleterious substances are present in the aggregates, the combined amounts shall not exceed 5 per cent by weight of the combined aggregate.

(b) Aggregates shall not contain strong alkali or organic material which gives a color darker than the standard color when tested in accordance with the "Standard Method of Test for Organic Impurities in Sands for Concrete" (Serial Designation: C40-22) of the American Society for Testing Materials.

(c) The maximum size of the aggregate shall be not larger than one-fifth of the narrowest dimension between forms of the member for which the concrete is to be used nor larger than three-fourths of the minimum clear spacing between reinforcing bars. By maximum size of aggregate is meant the clear space between the sides of the smallest square opening through which 95 per cent by weight of the material can be passed.

3. Water.

(a) Water used in mixing concrete shall be clean, and free from strong acids, alkalis, oil, or organic materials.

4. Metal Reinforcement.

(a) Metal reinforcement shall conform to the requirements of the "Standard Specifications for Billet-Steel Concrete Reinforcement Bars" of Intermediate Grade (Serial Designation: A15-14), or for "Rail-Steel Concrete Reinforcement Bars" (Serial Designation: A16-14) of the American Society for Testing Materials. The provision in these specifications for machining deformed bars before testing shall be eliminated.

(b) Wire for concrete reinforcement shall conform to the requirements of the "Tentative Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement" (Serial Designation: A82-27) of the American Society for Testing Materials.

(c) Structural Steel shall conform to the requirements of the "Standard Specifications for Structural Steel for Buildings" (Serial Designation: A9-24) of the American Society for Testing Materials.

(d) Cast-iron sections for composite or combination columns shall conform to "Standard

Specifications for Cast-Iron Pipe and Special Castings" (Serial Designation: A44-04) of the American Society for Testing Materials.

5. Storage of Materials.

(a) Cement and aggregates shall be stored at the work in a manner to prevent deterioration or the intrusion of foreign matter. Any material which has deteriorated or has been damaged shall be immediately and completely removed from the work.

CONCRETE QUALITY AND PROPORTIONING.

6. Concrete Quality.

(a) The working stresses for the design of this structure are based upon the minimum ultimate 28-day strength of the concrete to be used. The strength of concrete for which all parts of the structure were designed is shown on the several plans. The strength of concrete shall be fixed in terms of the water-cement ratio in accordance with one of the following methods:

(1) By established results for average materials, as provided in Sec. 7.

(2) By specific test of materials for the structure, as provided in Sec. 8.

(b) By the water-cement ratio is meant the total quantity of water entering the mixture including the surface water carried by the aggregate, expressed in terms of the quantity of cement. The water-cement ratio shall be expressed in U. S. gallons per sack (94 lb. net) of cement.

7. Water-Cement Ratio for Average Materials.

(a) Where no preliminary tests of the materials to be used are made, the water-cement ratios shall not exceed the values in the following table.

ASSUMED STRENGTH OF CONCRETE

Water-Cement Ratio ¹ U. S. Gallons Per Sack of Cement (94 Lb. Net)	Assumed Compressive Strength ² at 28 Days in Pounds Per Sq. In.
4	5000
5	3750
6	3000
6¾	2500
7½	2000
8¼	1500

¹ Surface water contained in the aggregate must be included as part of the mixing water in computing the water-cement ratio.

² The strengths indicated are for average materials, thoroughly mixed, and concrete moisture-cured at normal temperature of 70° F., tested damp.

(b) During the progress of the work, a reasonable number of compression tests shall be made as may be required by the architect, but at least one specimen shall be tested for each 100 cu. yd. of concrete being placed. The tests shall be made in accordance with the provisions for making field tests of concrete, as provided in Sec. 9.

(c) Should the average 28-day strength of the control cylinders cured moist at 70° F. fall below the minimum ultimate strength

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called for on the plans, the architect shall have the right to change the water-cement ratio. In the event that the architect finds it necessary to change the water-cement ratios from those specified, adjustment, covering amount of cement and aggregates affected, will be made as an extra or a credit under the provisions of the contract.

(d) Should the average strengths shown by the cylinders cured on the job and tested subsequent to 28 days fall below the required strength, the architect shall have the right to require conditions of temperature and moisture necessary to secure the required strength.

8. Water-Cement Ratio by Test of Materials.

(a) Where the water-cement ratios for the various strengths of concrete are to be established by test, these tests shall be made in advance of the beginning of operations, using the materials proposed and consistencies suitable for the work and in accordance with the "Standard Method of Making Compression Temporary openings shall be provided where necessary, to facilitate cleaning and inspection immediately before depositing concrete. Tests of Concrete" (Serial Designation: C39-27) of the American Society for Testing Materials, including the provisions for curing in a moist room at 70° F. and testing wet. A curve representing the relation between the average 28-day strength of the concrete and water-cement ratio shall be established for a range of values including all of the strengths called for in the plans. The tests shall include at least four different water-cement ratios and at least four specimens for each water-cement ratio, each specimen made from a separate batch. The water-cement ratio to be used in the structure shall be that corresponding to a point on the curve, established by these tests, representing a strength of concrete 15 per cent higher than the minimum ultimate strength called for on the plans and satisfactory evidence shall be submitted to show that these water-cement ratios are not exceeded during the construction of the building. No substitution shall be made in the materials being used on the work without additional tests in accordance, herewith, to show the new water-cement ratios to be used.

(b) During the progress of the work, a reasonable number of additional 28-day compression tests may be required, but at least one specimen shall be tested for each 50 cubic yards of concrete of any one strength, and not less than two specimens of each strength of concrete for any one day's operation. Such tests shall be made in accordance with the provisions in Sec. 9 for making field tests of concrete. Should the average strengths of the control cylinders cured moist at 70° F. shown by these tests for any portion of the structure fall below the minimum ultimate 28-day strengths called for on the plans, the architect shall have the right to order a change in the mix or the water-cement ratios for the remaining portion of the structure, but no extra claim shall be allowed for such changes. Should the average strengths shown by the cylinders cured on the job and tested subsequent to 28 days fall below the required strength, the architect shall have the right to require conditions of temperature and moisture necessary to secure the required strength.

9. Field Tests of Concrete.

(a) Field tests of concrete, when required, shall be made in accordance with the "Standard Method of Making Compression Tests of Concrete" (Serial Designation: C39-27) of the American Society for Testing Materials with the following exceptions:

(1) Two sets of samples of concrete for test specimens shall be taken as the concrete is being delivered at the point of deposit, care being taken to obtain a sample representative of the entire batch.

(2) One set designated as control cylinders shall be placed under moist curing conditions at approximately 70° F. within 24 hours after molding and maintained therein until tested.

(3) The second set, designated as job cylinders, shall be kept as near to the point of sampling as possible and yet receive the same protection from the elements as is given to the portions of the structure being placed. Specimens shall be kept from injury while on the work. They shall be sent to the laboratory not more than 7 days prior to the time of test and while in the laboratory shall be kept in the ordinary air at a temperature of approximately 70° F.

(b) All specimens and tests shall be made by a properly qualified person or testing laboratory, who shall furnish the architect with a report, certified in the presence of a notary public, showing the results of tests and stating that they were made in accordance with the provisions of this specification.

10. Concrete Proportions and Consistency.

(a) The proportions of aggregates to cement for concrete of any water-cement ratio shall be such as to produce concrete that will work readily into the corners and angles of the form and around the reinforcement without excessive puddling or spading and without permitting the materials to segregate or free water to collect on the surface. The combined aggregate shall be of such composition of sizes that when separated by the No. 4 standard sieve, the weight retained on the sieve shall not be less than one-third nor more than two-thirds of the total nor shall the amount of coarse material be such as to produce harshness in placing or honeycombing in the structure. When forms are removed, the faces and corners of the members shall show smooth and sound throughout.

(b) The methods of measuring concrete materials shall be such that the proportion of water to cement can be accurately controlled during the progress of the work and easily checked at any time by the architect or his authorized representative.

MIXING AND PLACING CONCRETE.

11. Removal of Water from Excavation.

(a) Water shall be removed from excavations before concrete is deposited, unless otherwise directed by the architect. Any flow of water into the excavation shall be diverted through proper side drains to a sump, or be removed by other approved methods which will avoid washing the freshly deposited concrete. Water vent pipes and drains shall be filled by grouting, or otherwise, after the concrete has thoroughly hardened.

12. Cleaning Forms and Equipment.

(a) Before placing concrete, all equipment for mixing and transporting the concrete shall be removed from the places to be occupied by the concrete, forms shall be thoroughly wetted (except in freezing weather) or oiled, and clay or cement tile that will be in contact with concrete shall be well drenched (except in freezing weather). Reinforcement shall be thoroughly cleaned of ice or other coatings.

13. Inspection.

(a) Concrete shall not be placed until the forms and reinforcement have been inspected by the architect or engineer responsible for the design or his authorized representative.

14. Mixing.

(a) The concrete shall be mixed until there is a uniform distribution of the materials and the mass is uniform in color and homogeneous. The mixer shall be of such type as to insure the maintaining of the correct propor-



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tions of the ingredients. The mixing shall continue for at least one minute after all the ingredients are in the mixer.

15. Transporting.

(a) Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent the separation or loss of the ingredients. It shall be deposited as nearly as practicable in its final position to avoid rehandling or flowing. Under no circumstances shall concrete that has partially hardened be deposited in the work.

(b) When concrete is conveyed by chuting, the plant shall be of such size and design as to insure a practically continuous flow in the chute. The slope of the chute shall be such as to allow the concrete to flow without separation of the ingredients. The delivery end of the chute shall be as close as possible to the point of deposit. When the operation is intermittent, the spout shall discharge into a hopper. The chute shall be thoroughly flushed with water before and after each run; the water used for this purpose shall be discharged outside the forms.

16. Placing.

(a) When concreting is once started, it shall be carried on as a continuous operation until the placing of the section or panel is completed.

(b) Concrete shall be thoroughly compacted by puddling with suitable tools during the operation of placing, and thoroughly worked around the reinforcement, around embedded fixtures, and into the corners of the forms.

(c) Where conditions make puddling difficult, or where the reinforcement is congested, batches of mortar containing the same proportion of cement to sand used in the concrete, shall first be deposited in the forms and the operation of filling with the regularly specified mix be carried on at such a rate that the mix is at all times plastic and flows readily into the spaces between the bars.

(d) A record shall be kept on the work of the time and date of placing the concrete in each portion of the structure. Such record shall be kept until the completion of the structure and shall be open to the inspection of the architect.

Note: Specifications covering finishing of concrete surfaces should be added. Methods of finishing are so varied they cannot be given in a general specification.

17. Curing.

(a) Exposed surfaces of concrete shall be kept moist for a period of at least 7 days after being deposited. In hot weather, exposed concrete shall be thoroughly wetted twice daily during the first week.

18. Depositing in Cold Weather.

(a) When depositing concrete at freezing or near freezing temperatures, the concrete shall have a temperature of at least 50° F., but not more than 120° F. The concrete shall be maintained at a temperature of at least 50° F. for not less than 72 hours after placing or until the concrete has thoroughly hardened. When necessary, concrete materials shall be heated before mixing. Dependence shall not be placed on salt or other chemicals for the prevention of freezing. No frozen materials or materials containing ice shall be used. Manure shall not be applied directly to concrete when used for protection.

FORMS AND DETAILS OF CONSTRUCTION.

19. Design of Forms.

(a) Forms shall conform to the shape, lines, and dimensions of the member as called

for on the plans. They shall be substantial and sufficiently tight to prevent leakage of mortar; they shall be properly braced or tied together so as to maintain position and shape and insure safety to workmen and possessors.

20. Removal of Forms.

(a) The removal of forms shall be carried out in such a manner as to insure the complete safety of the structure. Where the structure as a whole is supported on shores, removable floor forms, beams and girder sides, column and similar vertical forms may be removed within 24 hours, providing the concrete has hardened sufficiently that it is not injured. In no case shall the supporting forms be disturbed until the concrete has hardened sufficiently to permit their removal with safety. Shoring shall not be removed until the member has acquired sufficient strength to support safely its weight and the load upon it.

21. Cleaning and Bending Reinforcement.

(a) Metal reinforcement, before being placed, shall be free from rust scale or other coatings that will destroy or reduce the bond. Reinforcement shall be formed to the dimensions indicated on the plans. Cold bends shall be made around a pin having a diameter of four or more times the least dimension of the bar.

(b) Metal reinforcement shall not be bent or straightened in a manner that will injure the material. Bars with kinks or bends not shown on the plans shall not be used. Heating of reinforcement for bending will not be permitted.

22. Placing Reinforcement.

(a) Metal reinforcement shall be accurately placed and secured, and shall be supported by concrete or metal chairs or spacers, or metal hangers.

23. Splices and Offsets in Reinforcement.

(a) In slabs, beams and girders, splices of reinforcement shall not be made at points of maximum stress without the approval of the architect. Splices, where permitted, shall provide sufficient lap to transfer the stress between bars by bond and shear.

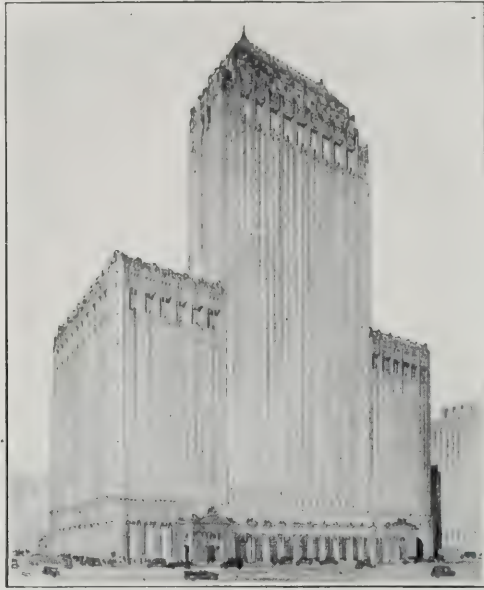
(b) Splices in column bars shall provide a lap of 24 diameters for deformed bars and 30 diameters for plain bars.

24. Construction Joints.

(a) Joints not indicated on the plans shall be so made and located as to least impair the strength of the structure. Where a horizontal joint is to be made, any excess water and laitance shall be removed from the surface after concrete is deposited. Before depositing of concrete is resumed, the hardened surface shall be cleaned and roughened and all weak concrete removed.

(b) At least 2 hours must elapse after depositing concrete in the columns or walls before depositing in beams, girders or slabs supported thereon. Beams, girders, brackets, column capitals, and haunches shall be considered as part of the floor system and shall be placed monolithically therewith.

(c) Construction joints in floors shall be located near the middle of spans of slabs, beams and girders, unless a beam intersects a girder at this point, in which case the joints in the girders shall be offset a distance equal to twice the width of the beam. In this last case provision shall be made for shear by use of inclined reinforcement.



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HOLLOW CLAY BUILDING TILE SPECIFICATIONS

Application and Installation

1. Work and Materials required to be furnished under this division of the specifications comprehends and includes everything in the way of material, transportation and labor required for furnishing and erecting in place in the building complete ready for use of all structural "Hollow Burned Clay Building Tile" of every sort including all mortar, scaffolding, forms, centers, hauling, hoisting, placement and cleaning up after completion, for clay tile foundations, walls including party division and fire, partitions, furring, fireproofing, floor and roof construction, combination hollow clay tile and concrete floor construction, etc., placed under "General Conditions of the Contract" as defined in documents known as the "Illinois Building Contract Documents" and special general conditions enumerated as follows:

A. Skilled Masons, Mechanics and Laborers, as required for the proper execution of same shall be employed on this construction work who shall be fully and carefully supervised by responsible, competent authority.

B. Apparatus including hoisting devices, machinery, tools, equipment, forms, centering, necessary to carry on this work shall be furnished so as not to unnecessarily delay the progress of the building or other contractors and without retarding the rate of progress stipulated in the contract.

C. Drawings shall be furnished as necessary to accurately locate setting and detail adaptation to structural shapes consisting of large scale details or full sized drawings for all special shapes required, including column coverings, girder covers, lintel covers and general type of arch. Drawings shall be submitted to the architect for approval before tile is burned.

2. Common Physical Characteristics of hollow burned clay building tile shall be those established by the American Society for Testing Materials and the Bureau of Standards of the U. S. Government. According to physical tests, tile shall be classified on the basis of strength and absorption requirements both of which shall be met for a given class in strict accord with the enumeration which follows:

A. HOLLOW BURNED-CLAY LOAD-BEARING BUILDING TILE

Class	Absorption, per cent		Compressive Strength, Based on Gross Area, lb. per sq. in.			
			End Construction		Side Construction	
	Mean of 5 tests	Individual Maximum	Mean of 5 tests	Individual Minimum	Mean of 5 tests	Individual Minimum
Hard	12 or less	15	2000 or more	1400	1000 or more	700
Medium	16 or less	19	1400 or more	1000	700 or more	500
Soft	25 or less	28	1000 or more	700	500 or more	350

Color shall not be taken as indicative of classification as different types of clay produces different colors of the same relative hardness and density and different types of clay are used in the manufacture of tile of same physical qualities.

B. End Construction Tile when used on the side shall meet the requirements of that construction and vice versa.

C. Masonry Strength for Clay Tile Walls of varying thickness shall vary uniformly in proportion to wall area. Tile for different wall thicknesses shall be designed to meet this requirement.

D. Dry Weight for tiles of various sizes and cell numbers shall not vary more than 5% from the enumeration which follows:

			Number of	Stand- ard Weight
Size of Unit in.			Cells	Lb.
3¾ by 12	by 12.....		3	20
6 by 12	by 12.....		6	30
8 by 12	by 12.....		6	36
10 by 12	by 12.....		6	42
12 by 12	by 12.....		6	48
12 by 12	by 12.....		9	52
3¾ by 5	by 12.....		1	9
8 by 5	by 12.....		2	16
8 by 5	by 12.....		3	16
8 by 5	by 12 ("L" Shaped).....			16
8 by 6¼	by 12 ("T" Shaped).....		4	16
8 by 7¾	by 12 (Square).....		6	24
8 by 10¼	by 12 ("H" Shaped).....		7	32
8 by 8	by 8 (Cube).....		9	18

E. Dimensions in any particular shall not vary more than 3% for any form of tile.

F. Weather Resistance of Tile for exterior work shall be such that it will be able to withstand 100 alternate freezings and thawings. Tile classed as "hard" or "medium" by these specifications may be classified as meeting weathering requirements provided they are burned to the normal maturity for the given clay. Tile classed as "soft" shall be classified according to results of freezing tests.

G. Fire Resistance rating shall be in strict accord with the Bureau of Standards requirements, serial 617-BS and the standards established by special report of Underwriter's Laboratories. Special shapes where asking for ratings higher than indicated on this report shall carry certificate of the manufacturer guaranteeing such higher ratings.

3. Clay for Manufacture of Hollow Clay Tile shall be fire clay, shale or admixtures of same. These clays may be used in any kind of hollow clay tile. Surface clay of approved quality may be used only for the manufacture of interior non-load bearing tile, floors, girder and column covers, and for fireproofing. Exposed or exterior wall tile facing or veneering regardless of kind, shall be of low absorption ratios and manufactured of fire clay shale or admixtures of same.

4. Classification and Grade Marking of Clay Tile shall be legibly imprinted or indented in the exterior wall of each tile, together with the trade mark or name of the manufacturer so as to identify the character of the tile and its appropriate use. Manufacturers of tile shall guarantee the replacement of same without cost to users if the tile does not comply with the grade mark stamped on same by them. All tile used in construction shall conform to the standards established by the American Society for Testing Ma-

For Attaching Wood Grounds to Hollow Clay Tile Partitions *Specify V-EDGE TILE with Wood Inserts*

NOTES

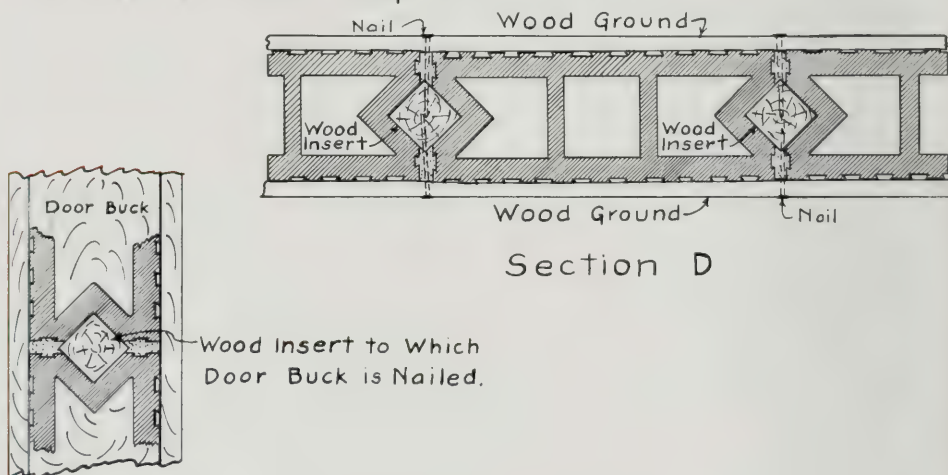
The (3) principal uses of this device are as follows:-

- (1) The securing of wood grounds.
- (2) The fastening of wood door bucks to the tile walls.
- (3) The spaces formed in tile walls provide enclosures for electric conduits without cutting tile.

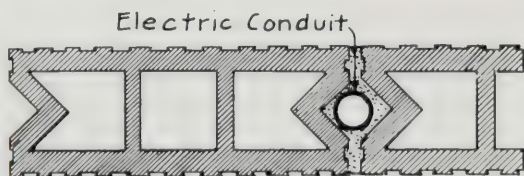
WOOD INSERTS (Soft Pine)

For 3" Tile - $1\frac{1}{4}$ " Stock in strips $1\frac{1}{4}$ " wide and 12" long.

For 4" Tile - $1\frac{1}{2}$ " Stock in strips $1\frac{1}{2}$ " wide and 12" long.



Section A



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terials. All tile shall be well burned, reasonably free from laminations, cracks, or other defects that would interfere with the proper setting of the tile or impair the strength or permanency of the construction, and shall be free from warpage or twist. Broken or imperfect tile shall not be used in construction.

5. Mortar for laying clay tile shall be mixed in mechanical mixers with quantities carefully measured as particularly specified and in quantities sufficient to insure the steady progress of the work. Hand mixing shall be permissible only when specially arranged for in strict accord with architect's specifications for mortars for this sort of work. Mortar containing Portland Cement shall not be re-tempered after it has taken its initial set. Proportions of ingredients, manner of placement, thickness of joints, etc., for various types of tile shall be in strict accord with the enumeration which follows:

A. Mortar for Load Bearing Walls shall be composed of one part Portland Cement to 1/6 part hydrated lime to three parts clean sharp sand. Such mortar shall not be re-tempered or used after it has taken its initial set.

B. Joints for Load Bearing Walls shall be so made as to develop full bearing for tile masonry and make the walls perfectly water and wind tight. Vertical Joints shall be perfectly filled wind and water tight both inside and outside for a distance of not less than 3/4" from the face, and left hollow between so as to form an air space. Structural fireproofing shall be filled solidly with mortar and aggregate avoiding the use of siliceous aggregates for filling.

C. Mortar for Non-Load Bearing Partitions, floor arches, and fireproofing shall be composed of one part by volume of Portland Cement to 1/3 part hydrated lime or lime putty to four parts clean sharp sand. If lime putty is used, same shall be made from freshly burned lime and thoroughly slaked.

D. Unfinished Exterior Walls shall be covered or protected from the elements and in no case shall clay tile wall construction be carried to a point higher than 6' in advance of the general level of masonry construction.

6. Foundation Walls from the top of footings to a point at least 12" above grade line shall be of hard burned clay tile low in absorption and set in a dense Portland Cement mortar. All walls shall be started upon solid concrete footings. The minimum thickness for foundation walls shall be 12".

A. Joists entering foundation walls shall rest upon tile bearing plates or solid masonry in lieu of same.

B. Joists in foundation walls shall be protected with closures and backing so as to prevent water entering walls.

C. Unglazed Tile where used for outside walls and basements shall be given an exterior coat of waterproof Portland Cement mortar or other approved dampproofing.

D. Glazed or Vitrified Tile Foundation Walls need not be waterproofed on the exterior but joints shall be carefully pointed perfectly water tight with Portland Cement mortar consisting of one part Portland Cement to two parts of clean sand.

E. Basement Floor Tile where used for paving basement floors shall be laid on a foundation or bed and set in manner as per following enumeration:

1st. **The Earth** underneath the floor shall be levelled off to a true even level free from hollows and tamped so as to make a compact level surface. Where the earth fill contains soft spots and over cesspools, vaults, and other excavations place a solid slab of

reinforced concrete material before applying cinder fill.

2nd. **Fill** on top of same with a 6" layer of bituminous cinders. Level off to a true even level and tamp or roll free from voids which might cause settlement.

3rd. **Tiles** shall be laid over same in true uniform manner with joints perfectly aligned and grouted with a Portland Cement grout consisting of one part Portland Cement to one part torpedo sand to 1 1/2 parts clean roofing gravel, well grouted into the joints and built up on surface to 1 1/4" in thickness above the tile and troweled off to a true even surface in strict accord with best cement finisher's practice. Tile for paving purposes shall be not less than 4" in thickness and of the kind known as "hard." It shall be dovetailed scored on the top surface so as to form a mechanical bond with cement top finish.

7. Exterior and Load Bearing Clay Tile Walls, where required to be constructed shall comply with standard specifications as to absorption, compressive strength area and weight for "Load-Bearing Building Tile" (C-34-24-T) and also shall meet special conditions as per enumeration which follows:

A. Placement shall be such as will develop the full strength of the tile when laid in the wall.

B. Exposed Surfaces of Walls either inside or outside shall be faced with tile of color and texture to match in spirit and intent the sample approved by the Architect.

C. Mortar Joints shall be of color, type and character as per samples laid up and approved by the Architect. It shall be the duty of the contractor to lay up different samples of tile for the Architect's approval.

D. Allowable Working Stress on hollow clay tile laid with the cells vertical shall in no case exceed 120 pounds and when laid with the cells horizontal 80 pounds, in each case per square inch gross horizontal cross sectional area of walls.

E. Allowable Thickness of walls shall in no case be less than the thickness prescribed by the law and good practice under similar placement for brick masonry.

F. Corners shall be carefully formed plumb on both sides with perfect tile free from defects, fully bedded in mortar and perfectly bonded to secure straight and true corners which will develop full strength.

G. Bonding of Face Brick Stone or Other Facing to hollow clay tile backing shall be with at least one row of full length headers in every seventh course of brick facing, or there shall be at least one full length header in every 90 square inches of wall surface area.

H. Facing Material Thickness shall be considered a part of the wall thickness but the maximum stress in such facing material shall not be assumed to exceed that allowable for tile backing (see Sec. 7-D).

I. Changes in Thickness of Walls where required to be made shall be so made as to transmit loads from vertical webs directly on top of webs below; where this is not practical or possible, tile slabs or solid brick masonry shall be introduced to distribute the load and not put strain on horizontal shells.

J. Concentrated Loads, wherever they occur on walls, shall be so distributed by means of spread metal bearing plates, beams or lintels or by brick concrete or other solid masonry as not to impose a unit stress on wall of more than that allowable for the type of tile used (see Sec. 7-D).

K. Excess Loads on Pilasters where more than proper allowable tile bearing load (see

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Sec. 7-D) shall be provided for by strengthening the pilaster in the following manner:

1st. **Insert Metal Rods** in the four corners of the pilaster of the size specified and if no size is mentioned, not less than $\frac{3}{8}$ ".

2nd. **Fill** all the cells of the pilaster and the wall back of same with concrete composed of one part Portland Cement to two parts clean sharp sand to three parts of gravel or crushed stone which will pass a $\frac{3}{4}$ " mesh screen and be retained on a $\frac{1}{4}$ " mesh.

L. **Joist Bearings** wherever joists are required to rest on walls shall be not less than 4" and shall be composed of bearing slabs of tile not less than 1" in thickness or solid brick masonry placed for bearing purposes. The sides, top and back of all floor joists where they rest on walls shall be surrounded with solid tile construction, solid brick masonry or closed tile, so that combustible construction does not come in contact with any openings in wall.

M. **Joist Anchors** where required to be used shall be placed at the bottom of joists so that if the joists fall for any cause whatsoever, they can drop down without putting leverage strain on the wall.

N. **Sills of Clay Tile** shall be formed with special shapes designed for that purpose of "dense" grade tile. These shapes shall be of such a nature as to form a shoulder or interlock underneath window frames so as to dam off and prevent water from running underneath same and they shall also be so designed as to drip free from wall. Joints shall be filled with Portland Cement mortar and wood sub-sills or frames shall be set in a thick heavy bed of mastic or rock putty.

O. **Lintels** not exceeding 5' in clear span shall be formed with load bearing tile reinforced with rods through cells and filled solid with concrete same as specified for filling pilaster (see Sec. 7-K). Such lintels shall be cast and allowed to season at least ten days before placing. They shall be reinforced in the top as well as in the bottom so as to facilitate placement without fracture. For size and amount of reinforcement see notes on drawings or in schedules or reinforcing.

P. **Openings** in clay tile walls shall have straight true tile jambs laid in workmanlike manner to provide a solid exterior surface using special shapes where required. When special shapes or jamb blocks are used, the installation shall be according to manufacturer's details and instructions. Wood Frames for such openings shall be carefully caulked around with oakum and mastic cement so as to make a perfectly water and wind tight bond between frames and walls. These frames will be designed with some form of wooden interlock or metal bond strip to form an interlocking bond between the wood and tile.

Q. **Arch Openings** shall be built to radius and camber as indicated by drawings using tile units small enough to attain proper curvature in order that the top of mortar joints may not be too heavy. Arch framing forms shall be placed which shall not be removed until work has thoroughly set up. The width of abutment must be sufficient to resist the thrust of arch and mortar used for arches shall be composed of Portland Cement and sand mixed in the proportions of one to three. Walls immediately above arches shall have one $\frac{3}{8}$ " bar laid horizontally in the joint of same for each 4" in thickness, requiring three bars for 12" wall and two bars for 8" wall.

R. **Special Shapes** where used to provide special bond features or for built in insulation shall be furnished and laid strictly in accord with manufacturer's directions.

S. **Furring Tile** wherever indicated on plans for exterior walls of building shall be 2" furring tile. These tile shall be anchored to the walls with metal ties built into the masonry every two courses in height and at intervals not greater than 36" in horizontal direction.

8. **Interior Non-Load Bearing Clay Tile Walls** where required to be constructed shall comply with standard specifications as to absorption, compressive strength area and weight for non-load bearing tile as prepared by the American Society for Testing Materials, Serial designation C-56-26T, with all amendments thereto to date, and shall also meet special conditions as per enumeration which follows:

A. **Tile for Walls and Partitions** shall be sound, uniform in shape, and free from imperfections which will impair its fire resisting quality, permanence, or durability for the purposes intended.

B. **Support** for non-load bearing tile partitions shall be arranged so that all partitions shall start on solid bearings and continue in straight and level courses, being firmly restrained at sides and top where same come in contact with other materials. In no sense shall non bearing clay tile partitions or walls carry any distributed and/or concentrated loading in excess of their own weight.

C. **Nailing Strips** shall be provided for the attachment of grounds at not to exceed 24" o.c. and so as to carry out the spirit and intent of Architect's detail drawings. Exception: if spot grounds, toggle bolts or clinch nails are specified or detailed, then nailing strips may be omitted.

9. **Chases** shall be built into load bearing walls using, if necessary, special shapes to be provided. Where the strength of walls will not be impaired, tile with vertical cells may be cut for the installation of vertical chases. Tile damaged in this process must be replaced satisfactorily before proceeding with other work. Under no circumstances shall tile walls or partitions be cut into for horizontal lines of pipe or conduit and any material so treated shall be replaced at the cost of the mechanic installing such pipe or conduit work to make a perfect complete and workmanlike job.

10. **Decorative Wall Treatment** for sanitary walls, special glazed tile, together with coves, special corners, caps or mouldings, shall be provided in accordance with architect's specifications. Texture surfaces, colors, kind, quality and manner of making mortar joints shall be in accordance with samples furnished and approved by the Architect.

11. **Floor and Roof Arch Clay Tile Construction** where required shall comply with standard specifications as to absorption, compressive strength, area, weight and design for floor and roof arch construction as prepared by the American Society for Testing Materials, serial designation C-57-26T with all amendments thereto to date, and shall also meet special conditions as per enumeration which follows:

A. **Spans** of hollow clay tile flat arch construction between steel floor or roof beams shall not exceed 8' 6". Span of segmental arch construction shall not exceed 12' except where specially designed in accordance with accepted engineering formula. The supporting beams for arch floor construction shall be tied together with steel tie rods.

B. **Tie Rods** in no case shall be less than $\frac{3}{4}$ " in diameter and spaced as required to resist the thrust of arch at not to exceed eight times the depth of the beam between tie rods or tie rod and girder. Tie rods shall be placed as near the point of thrust of the arch as practicable, and shall be completely incased within the construction to a depth

of at least two inches unless the tie rods are otherwise protected with fireproof covering below the soffit of arch.

C. Quality and Manufacture. Hollow clay tile for this form of construction shall be sound, hard, uniformly burned and shall be free from imperfections which would impair the structural properties, permanence, or fire-resistive quality of the construction, and shall have an (average) crushing strength of at least 2,000 lbs. per sq. inch of net sectional area when tested on end with the cells in alignment with the direction of pressure. The shells of hollow tile for arch construction shall not be less than $\frac{3}{8}$ " thick and the webs not less than $\frac{3}{8}$ " thick.

D. Flat Arch Construction shall not be less than 6" and all arches shall have at least two cellular spaces in the depth and unless reinforced by steel shall have a depth of not less than $1\frac{1}{2}$ " per foot of span. All arches shall be set on properly designed skewbacks that are cut to fit and protect the various beam sections. Keys of the sizes required to fit the different spans shall be provided, all arches to be keyed up in the middle third span, and any additional wedging up required, to be done with tile slabs or slate. End construction arches shall be set with the tile in a direct line between beams.

E. Segmental Arches shall have a total depth of not less than 6" having two cellular spaces in the depth and no segmental arch shall have a rise of less than $\frac{3}{4}$ " per ft. of span. Segmental arches shall be set with broken joints and be securely wedged up with tile or slate.

F. Skewbacks for all arches shall be designed to receive the thrust of arch and properly transmit same to flange of beam, the point at which thrust is supported in all cases to be above the top of beam flange supporting the arch.

12. Fireproofing where required to be furnished shall comply with the standard specifications as to absorption, compressive strength, area, weight and design for fireproofing tile as prepared by the American Society for Testing Materials serial designation C-56-26T, and all amendments thereto to date, and shall also meet special conditions as per enumerations which follow:

A. Supporting Beams, Girders, Lintels and other steel members shall be encased in hollow tile fireproofing throughout their entire length. All important beams and girders shall be incased independently of the floor arch construction, and wherever possible any openings that are required shall be left in the arch construction to avoid cutting. The minimum thickness of hollow tile fireproofing shall be as follows:

(a) **Soffit Covering** on beams carrying flat arches $1\frac{1}{2}$ ".

(b) **Covering** on beams, girders, etc., 2".

(c) **Covering** on inside projections of wall beams, lintels, etc., 2".

B. Wall Columns and Girders wherever hollow clay tile is used for fireproofing of wall columns, wall girders, or spandrel beams, etc. in exterior walls, the minimum thickness of hollow tile covering on these steel members shall be the same as that required for brick masonry covering and the thickness of solid material be at least equal to that specified for hollow tile fireproofing of interior columns. Hollow tile covering shall be well bonded and tied around columns and into the enclosing walls, and all channel spaces in wall columns shall be filled solid, same as required for interior columns. In no case shall any projection of the steel beyond the edge or face of columns, or the extreme outer edge of flanges of wall beams, or the plates and angles attached to same come within less than 2" of the exterior face of fireproof covering.

C. Interior Columns, Struts, or Other Vertical Supports of structural steel, wrought iron or cast iron, including the connection plates, shall be entirely incased and protected with hollow tile not less than 3" in thickness.

D. Beam Connections, Lugs, Brackets, Etc., attached to columns shall be covered with fireproofing of not less than 1" thickness of solid material over the extreme outer edge of metal.

E. Channel Spaces in Columns if not specified or shown to be filled with other fireproof material shall be filled with hollow tile, and the fireproof covering applied around the filled column. In all such cases all exposed steel shall be plastered with a full $\frac{1}{2}$ " coating of Portland Cement mortar as the channel filling and column covering is applied so that every bit of metal is first covered with a $\frac{1}{2}$ " coat of Portland Cement plaster.

F. Chases in Fireproof Covering shall not be cut under any circumstances and all pipe and conduit shall be kept outside fireproof covering excepting that outlets on the face of columns may have one electric conduit not exceeding $\frac{3}{4}$ " in size built into the channel filling when placed with at least 3" thickness of fireproofing material between same and the steel columns and securely built in before the fireproof covering is erected. The outside elbow shall extend out to face of fireproof covering and be solidly built in with not less than 3" thickness of tile brick or cement mortar between back and sides of outlet box and any metal.

G. Hollow Clay Tile Column Fireproofing shall be set in cement mortar as hereinafter specified and shall be securely bound with not less than No. 12 gauge wires once in every course or be tied together in every course with "U" shaped clips of No. 13 gauge band iron and shall be plastered at least $\frac{1}{2}$ " in thickness with mortar or heat retarding composition.

Note. **Column Fireproofing in Warehouses** where subject to damage from trucking will be protected to a height of at least 3' by metal plates or cast iron covering, but this metal covering will be furnished by the contractor for miscellaneous iron and this contractor shall co-operate with him in setting same.

13. Combination Hollow Clay Tile and Concrete Floor Construction where required shall comply with standard specifications as to material, density, absorption, compressive strength, area, weight and arrangement for combination hollow clay tile and concrete construction as prepared by the American Society for Testing Materials, serial designation C-57-26T, with all amendments thereto to date, and shall also meet special conditions as per enumeration which follows:

A. In General hollow clay tile and concrete floor construction is understood to consist of reinforced concrete joists between rows of hollow tile. When concrete topping over the tile is figured as part of the structural slab, same shall be cast monolithic with the concrete joist system. All floor slabs and beams shall have at least 4" bearing on the wall and if the bearing is on a tile wall, then a section of concrete the full length of tile wall and not less than 4" wide shall be cast over the tile wall to spread the bearing between beams and this section shall be reinforced in the direction of the length of the wall.

B. Forms shall be of such a size, lumber, and so placed as to prevent deflection and shall be provided in such quantity as not to delay the progress of the work. Care shall be taken not to remove the forms before the concrete is set. Under long spans the center row of supports shall be maintained for at least three weeks after the concrete has been poured. In cold weather, the contractor shall

leave the forms in place until directed by the Architect to remove same. No concrete shall be poured when the temperature is below 34° Fahr., unless provision has been made for heating and protecting the work.

C. Tile shall be hard burned, free from damage, imperfections and properly scored on all exterior surfaces. Joints in tile between concrete joists shall be staggered in adjacent rows by starting alternately with half and whole tile so that joints in tile will not come opposite each other in alternate rows.

D. Reinforcing Steel shall be deformed bars of hard grade steel offering a mechanical bond with the concrete. Reinforcing shall be free from mill or rust scales and shall be imbedded not less than one diameter nor less than $\frac{3}{4}$ " away from the exterior face of all concrete. Sizes of reinforcing shall be determined by the span and load to be carried as indicated on structural drawings.

(a) **Reinforcing** shall be supported with chairs and wired or otherwise tied in position so as to hold position during the process of placing concrete, substantially as shown by detail drawings.

(b) **Temperature and Expansion Reinforcement** shall be placed on top of tile running continuously in direction opposite to the direction of the length of joists consisting of not less than $\frac{3}{8}$ " bars placed not to exceed 16" o.c. and lapped not less than 8" at all splices, or in lieu of $\frac{3}{8}$ " bars approved fabric may be substituted of approximately equal weight and not less than 4" mesh.

E. Wheeling Planks shall be supported above the tile and reinforcing in such a manner as not to cause breakage of tile by vibration when wheeling over same or not to cause displacement of reinforcing.

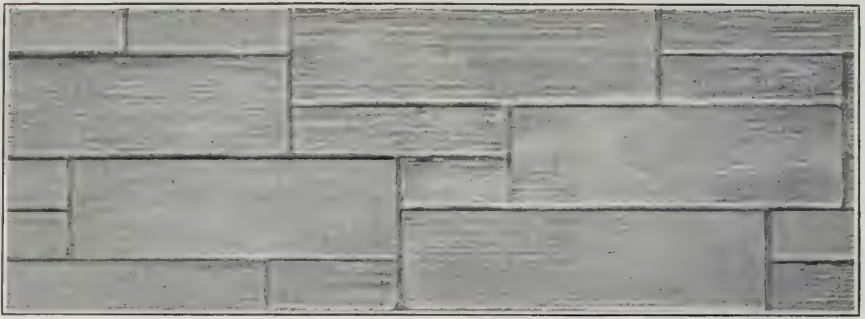
F. Concrete used in floor construction shall consist of 7½ gal. water to one cu. ft. best American Portland Cement, to two cu. ft. clean sharp sand, torpedo or equal which will pass a $\frac{1}{4}$ " mesh, and 3½ cu. ft. crushed stone or gravel of such a size as will pass through a $\frac{1}{2}$ " mesh and be retained on a $\frac{1}{4}$ " mesh.

(a) **Concrete** as placed shall be well spaded and worked around reinforcing after pouring so as to make a solid, dense concrete which shall be perfectly bonded with the reinforcing and entirely free from voids.

(b) **The Placing of Concrete** shall be a continuous operation and the full depth of floor shall be poured at one time.

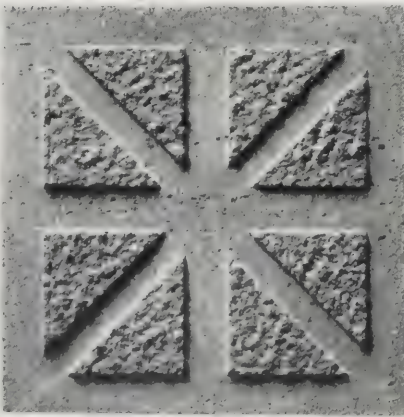
(c) **All Tile** should be wet before concrete is poured to effect good bonding. Soaking is not permissible. In pouring the ribs the concrete shall not be dumped into the joist, but on the previously placed concrete and worked forward, allowing the mortar to flow ahead in the joist.

(d) **Cessation-of-the-Work Joints** whenever required to be made shall be made exactly in the center of spans by setting vertical stop off dams and wherever cessation-of-the-work joints are made there shall be inserted in same metal stubs or dowels of sufficient number and area to develop at least three-fourths of the complete computed compressive strength of the concrete at the joint without reliance on butted joints in concrete, in excess of $\frac{1}{4}$ its computed strength. These stubs shall extend into the concrete on each side of the bond not less than 4". Under no circumstances shall stop-off joints be left with an incline from the vertical.



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Indiana Limestone constitutes one of the great natural resources of the country. The industry has grown to such an extent that it is in no sense local or sectional but national in character, and since this stone is so extensively specified by Architects, these grading rules, specifications and notes regarding its use have been included.

The Indiana Limestone Organizations through their Architects' Service Bureau offer free technical service to Architects, who are requested to make use of these Service Bureaus as a source of reliable and impartial information regarding the products of the industry and their proper and economical use, and for assistance on any problems pertaining to Indiana Limestone and its employment in building construction.

Notes on Standard Specifications for Indiana Limestone

THE SELECTION of the kind or grade of stone to be used for a particular building often does not receive the careful consideration which it deserves. When a building is intended to become the art or cultural center of a community, its administrative headquarters, or the realization of the life dream of some influential citizen, it is natural to think that only the very best is good enough. In such cases, there is a temptation to specify the fine-textured "Select" or what is really selected stone, the highest in cost, for all parts of the work. This is rarely necessary or desirable.

All grades of Indiana Limestone are equal, in so far as soundness is concerned. The production processes employed in a cut stone mill, further, are such as will automatically eliminate any blocks or pieces that contain planes of weakness, as the stresses set up in machining the stone and in handling it by the travellers from one machine to another, in the average run of work are greater than would be permitted in building, and serve to test effectively all of the stone as it passes through the various milling operations necessary to shape and prepare it for its position in the building.

For many types of structures, especially for sawed-finish wall facing, the Old Gothic grade, which is decidedly low in cost, is the most fitting to use. The moderate cost Variegated grade is suitable for all purposes, either for trim or for all stone faced buildings.

During the past few years the proportionate use of the Gray stone on account of its fine, close, even texture has been rapidly increasing. Many architects now prefer and specify it regularly, on account of its density, uniformity and fine weathering qualities, together with dignity and pleasing color-tone which becomes progressively lighter in shade with the passing years. It most effectively resists the accumulation of grime and in appearance is the nearest approach to a costly light-colored fine grain granite that it is possible to secure in the field of an easy-working, moderate cost building stone. Architects will never regret specifying this material for their finest work, as exemplified by some of the finest buildings in America that have been constructed of it.

UNIFORM CLASSIFICATION OF INDIANA LIMESTONE.

With descriptions of the grades as adopted by the Indiana Limestone Institute Sept. 26th, 1928.

Regular Classification.

Select Gray	Standard Buff
Standard Gray	Rustic Buff
Rustic Gray	Variegated
Select Buff	Old Gothic

Special Classification.

Buff Statuary Stock	*Special Hard Gray
*Special Hard Buff	

*These grades "Select" in texture.

Standard Practice—Samples.

The submitting of two samples showing the maximum and minimum or fineness and coarseness of texture has been adopted as "standard practice," thus showing the range of variation from uniformity instead of only one sample intended to indicate the average run of the particular grade—except in the case of "Statuary Buff" where a single sample will usually suffice, and in the case of Old Gothic, the characteristic range of which cannot be appropriately shown by only two samples and for which grade there is no fixed limit as to variation in texture and formation, or as to markings that are characteristic of the material.

Descriptions of the Grades defining the range of variation in texture and the markings that are characteristic of and permissible in the various grades under the Indiana Limestone Institute system of grading.

Select Gray.

"Select Gray" stock is sound and durable and shall embrace the average finer grained Gray stone, in texture ranging from the finest, most uniform grained stock to stone having an average grain, as shown by the samples and photo reproductions thereof designating the range of this grade. It shall include stone in which any openness of grain does not show pore spaces exceeding about one m. m. (1/25 inch) in diameter and in which tight fine opaque white or glass-like calcite streaks or veins not exceeding one m. m. (about 1/25 inch) in width, may occur and will include stone having occasional solid fossils and grains, crystals or spots of calcite. Pit-holes not exceeding six m. m. (about 1/4 inch) in diameter may occur, providing that there are not more than the equivalent of one of these to any ten square feet of area of slabs, nor more than 15% of the cube of blocks so affected, and in which any of these allowed minor variations in the formation and texture do not constitute a defect that impairs the strength and durability or appearance of the fabricated and finished stonework produced therefrom, and when appreciably affecting the appearance are such that can be eliminated readily from appearing on the face of stonework in the finished building.

Standard Gray.

"Standard Gray" stock is sound and durable and is the average of the moderately large grained Gray product of the quarries that constitutes the bulk of the total output of gray stone and is therefore classed as "Standard." This grade has certain variations in density, color-tone and texture not allowed in "Select" and may contain streaks of calcite or moderately coarse grained or reedy formation and small pit-holes, providing such variations in texture and color-tone do not exceed the following limits, or impair the strength or durability of the stone.

Texture or grain ranging from Select to a somewhat shelly appearing formation having



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BEDFORD, INDIANA



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ROY A. SANBORN

20 NORTH WACKER DRIVE

TELEPHONE, STATE 0111

an average grain, as shown by samples and photo reproductions thereof designating the range of this grade.

White calcite or crystalline streaks, not over four m.m. (about 1/6 inch) in width, nor more than one such marking in any 30 square feet of stone so affected.

Glass-like calcite streaks or veins not over two m.m. (about 1/12 inch) in width nor more than one such defect in any 30 square feet of stone so affected.

Coarse or open texture bands averaging not over one inch in width, nor shall not aggregate over 6% of the measurement across grain.

Pit or shell holes aggregating not over one square inch in area to any 30 square feet of stone.

Stock to be well cemented and with the exception of the pit-holes and coarse somewhat open-textured streaks allowed, shall not be visibly open or porous in general structure.

Rustic Gray.

"Rustic Gray" stock is sound and durable and shall embrace the coarser more or less open shelly grained Gray stone, having a varying amount of crystalline calcite intermixed, including stone having a decidedly coarse structure with some honey-comb formation, as shown by the samples and photo reproductions thereof designating the range of this grade. Rustic Gray by the nature of the deposit will generally be somewhat denser in formation than Rustic Buff, and regardless of its coarse shelly texture usually be practically free of any very open grain stone of more or less cellular formation like travertine, such as is characteristic of and will occur in the Rustic Buff grade, but may include some stone which is darker in color-tone, some stone with streaks of fine texture and some stone that is quite hard, due to the size and amount of crystalline calcite that it contains. This grade, like Rustic Buff, is coarser and more varying in texture, and shows a wider range of granular formation and variation in color-tone than any of other grades, excepting "Rustic Buff" and "Old Gothic."

Select Buff.

"Select Buff" stock is sound and durable and shall embrace the average finer grained stone, in texture ranging from statuary stock in which minor surface markings occur, to stone having an average grain as shown by the samples and photo reproductions thereof designating the range of this grade. It shall include stone in which any openness of grain does not show pore spaces exceeding one m.m. (about 1/25 inch) in diameter and in which tight fine opaque white or glass-like calcite streaks or veins not exceeding one m.m. (about 1/25 inch) in width may occur, and will include stone having occasional solid fossils and grains, crystals or spots of calcite. Pit-holes not exceeding six m.m. (about 1/4 inch) in diameter may occur, providing that there are not more than the equivalent of one of these to any ten square feet of area of slabs, nor more than 15% of the cube of blocks so affected and in which any of these allowed minor variations in the formation and texture do not constitute a defect that will impair the strength and durability or appearance of the fabricated and finished stonework produced therefrom, and when appreciably affecting the appearance are such that can be eliminated readily from appearing on the face of stonework in the finished building.

Standard Buff.

"Standard Buff" stock is sound and durable and is the average of the moderately large grained Buff product of the quarries that constitutes the bulk of the total output of Buff stone and is therefore classed as

"Standard." This grade has certain variations in density, color-tone and texture not allowed in "Select" and may contain streaks of calcite or moderately coarse grained or reedy formation and small pit-holes, providing such variations in texture and color-tone do not exceed the following limits, or impair the strength or durability of the stone.

Texture or grain ranging from Select to a somewhat shelly appearing formation having an average grain as shown by samples and photo reproductions thereof designating the range of this grade.

White calcite or crystalline streaks, not over four m.m. (about 1/6 inch) in width, nor more than one such marking in any 30 square feet of stone so affected.

Glass-like calcite streaks or veins not over two m.m. (about 1/12 inch) in width nor more than one such marking in any 30 square feet of stone so affected.

Coarse or open texture bands averaging not over one inch in width nor shall not aggregate over 6% of the measurement across grain.

Pit or shell holes aggregating not over one square inch in area to any 30 square feet of stone.

Stock to be well cemented and with the exception of the pit-holes and coarse somewhat open-textured streaks allowed shall not be visibly open or porous in general structure.

Rustic Buff.

"Rustic Buff" stock is sound and durable and shall embrace the coarser and irregular, more or less open shelly grained stone, having a varying amount of crystalline calcite intermixed, including stone having a decidedly coarse somewhat honey-comb or reedy formation, as shown by the samples and photo reproductions thereof designating the range of this grade. It may include some stone which is appreciably darker in color-tone, some stone with streaks of fine texture and some stone that is quite hard, due to the size and amount of crystalline calcite that it contains. This grade is therefore distinctly coarser and more varying in texture, showing a wider range of granular formation and more variation in color-tone than any other grade, except "Old Gothic."

Variegated.

"Variegated" stock is sound and durable and shall embrace the irregular mixture of the Buff and Gray color-tones which occur in the blocks that are quarried where the Buff and Gray color-tones adjoin in the quarry ledges and includes stone showing variation in texture as well as the variation in color-tone, as shown by the samples and photo reproductions thereof designating the range of this grade.

"Variegated" stock includes stone that may vary in texture from the lower range of "Standard" up through "Select" as herein graded by texture and consequently from moderately large to quite fine grained stone and will include some stone containing streaks or veins of crystalline calcite and bands or areas of shelly formation that do not affect the structural soundness of the stone, or make the stone stock too coarse or variable to be used for the average run of "cut stone" work, trim, etc.

The coarser grained and more variable of the vari-Buff-Gray color-toned stone that is equivalent to Rustic Buff or Rustic Gray in texture, shall be included in the "Old Gothic" classification.

It is understood that while the quarry blocks shall contain stone of both color-tones, that Variegated stock when cut up for building purposes, will, in the finished work, produce pieces of solid Buff and solid Gray and only a certain percentage of stone with the two color-tones in one piece.



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CHICAGO, ILL.

Old Gothic.

This grade of stock is sound and durable and embraces Gray, Buff and Variegated. It includes stone of pronounced texture, unselected as to color, ranging from a fine to a distinctly coarse grain, and may contain shelly, honey-comb formations with both white and dark crystalline streaks or streaks of glass-like calcite and tight crow-feet, none of which, however, affect the structural soundness and weathering properties of the stone. For this grade of stone there is no fixed limits as to variation in texture, general formation and surface markings, and when the material is fabricated some pieces will be produced in solid Buff and in solid Gray.

Special Hard Gray.

"Special Hard Gray" for the purpose of grading is classed as "Select Gray." It is the fine grained, hard, dense, stone similar to the regular Select Gray grade in texture and may be included as such, but as a grade by itself, shall be specially selected for its hard, dense, usually somewhat crystalline texture, making it particularly suitable for grade or base courses, steps, platforms, floor tiling, paving and other walkway surfaces.

Special Hard Buff.

"Special Hard Buff" for the purpose of grading is classed as "Select Buff." It is the fine grained, hard, dense stone similar to the regular "Select Buff" grade in texture and may be included as such, but as a grade by itself, shall be specially selected for its hard, dense, usually somewhat crystalline texture, making it particularly suitable for grade or base courses, steps, platforms, floor tiling, paving and other walkway surfaces.

Statuary Buff.

This grade covers only the very fine uniform grained Buff stock sold principally for sculpture and carved doorways, tracery, sculptured panels, memorials and elaborate interior work.

In texture the grain shall not exceed one millimeter (about 1/25 inch) in cross-section, visibly uniform and well cemented in structure and entirely free from seams, streaks and pit-holes, and without calcite crystals larger than four millimeters (about 1/6 inch) in diameter.

Certain specialties, from individual quarries that will range in color-tone from very light, almost a cream white, to distinctly dark, are also usually available, samples and descriptions of which will be furnished upon request.

Architects should remember that this system of classifying the Industry's product is for their direct benefit and the protection of their clients in the specifying of Indiana Limestone. The well-known Oolitic Limestone of Indiana, formerly called "Bedford Stone," is commercially available only in Lawrence and Monroe Counties, and the architect should protect both his client and himself against substitutes. All of the long established and proven quarries from which this dependable stone has been produced for generations are located within these two counties.

SPECIFICATION FOR CUT INDIANA LIMESTONE.

1. Work Included:

The work under this contract shall include all labor and material for the furnishing of cut stone work in accordance with the drawings and as hereinafter specified.

2. Description of Stone.

All Limestone specified or shown on drawings shall be Indiana Oolitic Limestone building stock, free from all defects that

would materially impair its strength, durability or appearance, and within the range of variation of color and texture represented by two samples approved by the Architect.

Specially graded stone, acceptable as to hardness and color, as per samples to be submitted, shall be employed where indicated on drawings, for and all other positions in contact with the soil or exposed to direct wear.

Wherever the terms "Indiana Limestone" or "Limestone" occur in this specification, they specifically refer to and shall imply "Indiana Oolitic Limestone" quarried in Lawrence or Monroe Counties, Indiana, all such stone to be from a quarry the product of which has been tested at the U. S. Bureau of Standards for physical properties and weathering with satisfactory results.

3. Finish.

The finish on exposed surfaces generally, except where tooling or carving is indicated, shall be smooth, machine-dressed, showing no tool marks.

4. Samples.

The contractor shall submit to the Architect two samples which shall be typical of the extremes which the contractor proposes to furnish. Samples to be about 3 1/2" wide by 7" long by about 3/4" thick, produced with the large faces cut across the grain of the stone, the finish specified to be indicated on the large faces and at least two of the edges to be rock face. Similar samples shall be provided when "special hard" stone or any other grade of stock is specified for certain positions in the building.

All samples shall be labeled or otherwise clearly marked with the grade of the Limestone, the name of the contractor submitting them, and with the statement: "Samples of Indiana Limestone to be furnished for the Building."

5. Standard Practice.

The standard practice established by the former Indiana Limestone Quarrymen's Association of Bedford, Ind., along with the grading rules of the Indiana Limestone Institute, shall govern, except where these are in direct conflict with the specific intent of the Architect's specifications or detail drawings. Bidders not familiar with the existing standards relating to the grading, cutting, setting and anchorage practice, etc., are cautioned to inform themselves regarding them.

The Architect reserves the right to approve the sub-contractors for both the cutting and setting of the stone, before this portion of the work is awarded.

6. Cutting & Setting Drawings.

The cut stone contractor shall prepare and submit to the Architect for approval, complete cutting and setting drawings, in triplicate, for all of the Limestone work under this contract and no stone shall be cut until these drawings are approved by the Architect. Such drawings shall show in detail the sizes, sections and dimensions of stone, the arrangement of joints and bonding, anchoring and other necessary details.

These drawings shall be based upon and follow the drawings and full-size details prepared by the Architect, except where it is agreed in writing that changes be made. Each stone indicated on these drawings shall bear the corresponding number marked on the back or bed with a non-staining paint.

7. Bonding & Anchorage.

All projecting stones, except where otherwise shown as anchored to the structure, and so provided for by details on setting drawings, shall have beds in the wall at least one-inch greater in depth than their maximum projection.

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Moulded projecting courses, unless shown as secured by suitable anchorage or steel supports, shall have not less than four-sevenths (4/7) of their cubic contents inside the face of wall. There shall be "through" or bond stones whenever indicated on the architect's drawings upon which contract is based.

Provision for the proper anchoring, dowering and cramping of work in keeping with standard practices, also for the support of stone by shelf angles and loose steel, etc., when required, shall be clearly indicated on the setting drawings.

8. Details for Lintels, Etc.

Lintels, architraves and other members spanning openings, whether supporting a superimposed load or only their own weight, shall be of the proportions and sectional area that will provide an ample factor of safety based on the average ultimate breaking strength of the stone specified.

9. Carving & Models.

All carving shall be done under this contract by skilled carvers in a correct and artistic manner, in strict accordance with the spirit and intent of the Architect's sketches, or from plaster models provided or approved by the Architect.

All carving to be executed

Contractor shall include in his estimate the sum of to be expended by the Architect for the models that are required.

10. Cutting.

All stone shall be cut accurately to shape and dimensions and full to the square, with jointing as shown on approved "cutting and setting" drawings. All exposed faces shall be cut true. Beds and all joints shall be dressed straight and at right angles to the face, unless otherwise shown, and except where otherwise shown or noted on drawings the joints shall have a uniform thickness of 1/4 inch.

The patching or hiding of defects will not be permitted.

Washes shall be as deep as practicable and drips of sufficient width and depth to shed water shall be provided on all projecting stones and courses.

Raglets for flashing, etc., shall be cut in the stone where so indicated on the architect's drawings.

Moulded work shall be carefully executed from fullsize details, supplied by the Architect, and must match perfectly at joints. All arrises shall be sharp and true.

Quoins, Pier and Pilaster stone shall be checked at back as indicated.

All columns shall be accurately cut with the entasis shown on drawings. All pilasters to be cut straight without entasis or taper.

11. Back Checking & Fitting to Structural Frame.

Stone coming in contact with structural work shall be back-checked as indicated on the general drawings, and where shown resting on structural work shall have beds shaped to fit the supports.

12. Lewis Holes & Cutting for Dowels, Anchors, Cramps, Etc.

Holes and sinkages shall be cut in stones for all anchors, cramps, dowels, etc., called for under this specification or indicated on the "cutting and setting" drawings.

Lewis holes shall be cut in all stones weighing more than 100 pounds. No Lewis or other holes shall be cut in exposed washes or come closer than 2 inches to the exposed face of the stone.

13. Cutting and Drilling for Other Trades.

This contractor shall do all cutting and drilling of stone for electric conduits, piping, leaders, etc., required for the installation of

the work of other trades, when definite information is given on architect's details.

14. Field Cutting.

Specify in detail any field cutting that will be required.

15. Loading & Shipment.

The Cut Indiana Limestone shall be carefully packed for rail or wagon transportation, with exercise of all reasonable and customary precautions against damage in transit.

All cut stone under this contract shall be delivered promptly as ordered by purchaser and in the sequence in which it is to be set.

SETTING CUT STONE.

16. Work Included.

Contractor shall refer to the preceding specification for Cut Indiana Limestone for more detailed information regarding the Cut Stone that is to be set under this contract; also refer to "General Masonry," "Sheet Metal Work," "Roofing" and "Carpentry" specifications for references to other work that must be executed in conjunction with this work.

17. Delivery & Storage.

All Indiana Limestone delivered f. o. b. cars at destination under contract shall be carefully unloaded and delivered to the building site.

The Cut Stone shall be handled throughout by competent workmen and by such methods as will guard against soiling, mutilation or snipping in transit to and upon delivery at the building site.

The stone shall be stored at the building site on planking set so that the stone will rest entirely clear of the ground and be protected by proper means from damage to arrises and from contact with anything which would result in the accumulation of dirt, dust, soot, mud, grease and other staining or disfiguring elements. The stone shall be covered with tarpaulin, stout non-staining paper or boards during extended periods of storage at destination or building site.

18. Setting Mortar.

All Indiana Limestone shall be set in a carefully prepared non-staining mortar. (See Alternate Mortar Clause which follows.)

Note:—The following three alternate setting mortar clauses; one for a cement mortar, one for a 50-50 mortar and one for a lime mortar, any one of which may be used according to the conditions which make each one the more appropriate for the particular piece of work. The lime mortar clause is recommended principally for what may be referred to as all lime mortar masonry jobs in which that type of mortar is to be used for laying up the backing as well as for setting the stone facing.

The 50-50 mortar clause is recommended both for the setting of stone in masonry walls where another type of mortar is to be used in laying up the backing, and for light walls in which it can be used both for setting the stone and laying up the backing.

The cement mortar clause is always to be recommended for both setting and parging the back of the stone, where a cement mortar made of ordinary cement, either Portland or brick masons of any questionable kind is to be used in the backing masonry and especially for the enclosure walls of skeleton frame structures where both a strong mortar is desirable and where a dense reasonably impervious mortar that will protect the stone where it is built in place against concrete column and beam construction or fireproofing is all important.

For that reason preference is usually given to the use of a cement of the non-staining type either containing or mixed with a suitable integral waterproofing as the most practical and effective means of protecting the stone from the staining effects of moisture coming through from the backing or structural work in back of limestone facing.

A. Cement Mortar.

All Indiana Limestone shall be set in a carefully prepared non-staining mortar composed of 1 part of approved brand of non-staining cement to 3 parts of sharp, clean washed sand with the addition of 1/5 part of Hydrated Lime.

B. Cement-Lime Mortar.

All Indiana Limestone shall be set in a carefully prepared non-staining mortar composed of 1/2 part of approved brand of non-staining cement, 1.2 part of Hydrated Lime or lump lime paste to not over 3 parts sharp, clean washed sand.

C. Lime Mortar.

All Indiana Limestone shall be set in a carefully prepared non-staining mortar composed of 1 part of Hydrated Lime or lump lime paste to not over 3 parts sharp, clean washed sand with the addition of non-stained cement in an amount equal to at least 15 per cent by volume of the lime used.

When lump lime is to be used the paste shall be made from the best quality of freshly burned lump lime, slaked with cold water and screened through a 3/8 inch mesh screen into a settling box, following the practice employed in preparing lime for plastering. The lime putty thus prepared shall stand in the settling box not less than one week and then be mixed with sand and be properly stacked to age; the cement to be added and thoroughly worked into the mixture in small batches just prior to its use for the setting of cut stone.

Note:—The following clause will apply for all three types of mortar.

The sand must be WASHED entirely free from loam, silt, vegetable matter, salts and all other injurious substances, and shall be screened if containing pebbles or coarse grains that would interfere with the proper bedding and jointing of the work. The water shall not be alkaline and must be clear and devoid of salts and injurious elements.

19. Scaffolding.

The scaffolding required for the use of all Trades, including scaffold for the proper execution of the Cut Stone work, will be furnished and erected by the Masonry Contractor.

20. Centering.

The wood centering required for the proper setting of Cut Stone work will be furnished and erected by the Carpentry Contractor.

21. Anchors & Dowels.

All anchors, cramps, Lewis anchors, etc., required by setting drawings or necessary for the proper erection of the work shall be included under stone setting contract. Except where otherwise specified, all anchors shall be of iron, thoroughly galvanized after they have been bent to shape.

Anchors for ashlar and face work generally shall be the standard 3/4"x1" ashlar anchor or be of equivalent cross-section, one anchor to each stone over one-half square foot in area and at least two anchors to all stone over 2'-0" long or more than 3 square feet in superficial area.

All dowels required for light stone work shall be made of standard heavy brass pipe of the size required.

22. Grade Course.

Where the Limestone extends down to the grade-line, the stone work above the grade shall be protected by a properly installed layer of approved non-staining impervious material.

23. Setting Cut Stone.

The Indiana Limestone shall be set accurately in accordance with the requirements of the drawings. Before setting, all stone shall be washed **clean on all sides** and, if required, shall be scrubbed with fibre brushes using only soap powder and water and then be thoroughly rinsed with clean water. Just prior to setting, all stone shall again be sponged or drenched on all sides with clean water.

All stone shall be properly set by competent stone setters, true to line and level, with full flushed joints, filling all anchor holes.

All beds and vertical joints shall be 3/4 inch in width, except where otherwise indicated. Wood wedges may be used only where necessary to prevent the crushing of mortar under heavy blocks, and shall be thoroughly soaked before use.

Mortar shall be raked out 3/4 inch from the face of stone to allow for pointing; excepting for such parts of the work as may best have the joints pointed or grouted full as set. The stone as set shall be sponged off along all joints.

Steps shall be set with a slight pitch to the front.

The ends only of lugged sills shall be bedded with mortar, balance of joint to be left open until pointed.

Heavy stone or projecting courses shall not be set until the mortar in courses underneath has hardened, all projecting stone to be securely propped until the wall above them is built.

All cornices, copings and projecting belt courses and all stones forming gutters, etc., shall be set with the vertical joints unfilled. The exterior profile of these joints shall then be caulked with rope yarn or picked oakum and be filled solid from above with a mortar grout composed of one part non-staining cement and one part fine white sand, mixed in small quantities, and of as thick a consistency as can be poured into the joints. Grout shall be stirred vigorously until used.

Splashing exposed faces of stone with mortar shall be avoided and any splashes be immediately removed with a clean sponge and water.

24. Parging & Backing Up.

The backs of all stones and the sides of bonding stones shall be parged with the setting mortar not less than 1/2 inch thick before backing is built. *The first course of brick in back of stone shall be laid in this same kind of mortar.* Where the stone occurs as a facing applied direct to previously erected structural members, both back of stone and face of structural work shall be plastered with setting mortar and any space left be grouted where this is required, to insure a thoroughly filled back-joint.

25. Protection of Finished Work.

Contractor setting Cut Stone shall co-operate with the Carpentry Contractor, who will furnish and erect the necessary protection for sills and all projecting stonework. All steps and platforms shall be protected with boards during the entire period of construction.

26. Replacement Damaged Stone.

No defective stone, and no broken, spalled, patched or otherwise damaged stone shall be set without first obtaining the Architect's approval. All damaged stone shall be recut or repaired, if approved, or be replaced by the contractor free of cost to the owner.

27. Pointing.

All face joints shall be raked and brushed out clean to a depth of at least $\frac{1}{2}$ inch, carefully removing any wedges and loose mortar so that pointing will be continuous, and after a thorough wetting of the stone, the joints shall be pointed flush with mortar consisting of one part non-staining cement, two parts clean white sand and sufficient cold lime putty to make as stiff a mixture as can be worked.

28. Cleaning.

The face of all stonework under this contract shall be properly cleaned down upon completion; if necessary, this cleaning shall be done with a suitable steam cleaning process approved by the architect or by scrubbing with soap powder boiled in clean water, applied vigorously with stiff fibre brushes, adding clean, sharp, fine sand to the soap and water mixture, drenching all exposed surfaces of stone with clear water after cleaning, or in lieu of that method be cleaned down with a suitable steam cleaning process approved by the Architect.

The use of wire brushes or acids of any kind will not be permitted under any circumstances for cleaning the stonework.

Note: Where the contractor has thoroughly cleaned the stone before its erection, the cleaning down upon completion may often be omitted, or at least consist only of the removal of mortar droppings and the brushing off of stone, together with the careful sponging off of mortar smears along the joints as pointing progresses.

Notes on the Design of Structural Steel for Skeleton Frame Buildings That Are to Be Faced With Stone.

It is really very important that more careful consideration be given to the requirements of the facing material in the preliminary layout of structural steel work than is often the case.

The facing material, along with the details of support for enclosure walls, is very often studied only after the size and position of columns, girders and main beams, including even the spandrel members, have been fixed. This is not the best method of procedure, as a careful study of the spandrel sections during the preliminary stages of design and layout of the structural frame will often result in considerable economy in the steel work.

Details for spandrel sections should be carefully worked up in pencil during the early stages of preparing the small scale drawings, enabling them to be studied along with the architectural features of the design and before the column centers and other lines have been definitely fixed, not afterward.

It must also be remembered that masonry, particularly cut stone work, is decidedly more rigid than steel, and the steel work for its support should be designed with this fact in view. Any attempt to support walls or lintels over wide openings with shallow steel sections that will deflect appreciably under load, will cause arch action in the super-imposed masonry so that the load will be carried by the masonry instead of being transferred to the beam in accordance with the design. When this occurs, parts of the masonry walls may be subjected to stresses so excessive that crushing or opening of the joints or even spalling of the corners or cracking of the masonry sometimes results. This may often mean that a single, deep, built-up plate-and-angle girder is preferable to a plain rolled section or combination of shapes for spandrel members.

For similar reasons, it is better to carry the entire spandrel load on a single beam or

girder than on two or more separate ones. The weight of steel will usually be less, the beam stiffer and all the steel will act together.

In many cases, provision should be made for adjustment of shelf angles, outlooks, etc., at the time stone is set. This may be accomplished by the use of slotted bolt holes, washers, and bolts of adequate length. On account of this requirement for adjustment, loose angles, channels, etc., for the support of stone are much easier to set and, consequently, are preferable when the above requirement for stiffness can be adequately met.

A similar point is so to detail the work that the stone facing will not be pinched between supporting members of the structural frame when movements occur due to changes in temperature, wind stresses, etc. Thermal expansion of limestone, under temperature changes occurring in a building, are very much less than that of steel.

Stone lintels should be made self-supporting whenever practicable. This is usually possible, even in paired or grouped windows, by the use of stone mullions, which give a better appearance and greater structural stability to any stone design. This often simplifies the spandrel sections, since in this case only the spandrel panels and sills need be supported by the structural frame.

There is also a tendency to place wall columns too close to the face of outside walls. In the shaft or main portion of the building, it is usually advisable to fix the center line of these columns in a position that will provide room between the outer face of the steel and the normal face of the wall for the stone facing and one course of brick work, plus the proper allowance for joints. With columns placed in this position, the eccentric loading from walls can generally be balanced by the eccentric loading from floor girders, and this will usually permit the flanges for the regular plate-and-angle columns to be turned out towards the face of the wall, where they best serve for resisting wind stresses and for wind bracing connections, permitting the floor girder connections to be placed on the opposite flange of these columns.

It is also very important in the erection to be sure that the frame is carrying all of the enclosure wall load which it is intended to carry, and that this load is not being supported largely by the facing through the deflection and settling to bearing, of the steel work behind it. This may often mean that in tall buildings the erection of stone facing and backing of enclosure walls should be started simultaneously at several different floor levels, and the entire enclosure walls of the shaft and upper portions of the building be completed before the stone work of base or lower stories is set.

It may not always be found practicable to do this, but the one point is to be sure that the frame is carrying the full load of upper walls, particularly when there is an arcade or colonnade treatment of stone work forming the base portion of a tall building as stone work of this character in lower portion can usually be made self-supporting for several stories in height, and for that reason steel should be kept out of it as far as practicable.

A little careful study given to details of this kind during the early stages of the steel design will usually result in the simplification of both the structural steel and the stone work, facilitate the erection of both, and reduce the cost.



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In accordance with the unanimous action on December 12 to 13, 1923, April 22, 1924, May 1, 1925, April 27, 1926, and May 3, 1928, of the general conferences of representatives of manufacturers, distributors, wholesalers, retailers, and users of lumber, and representatives of architects, engineers and general contractors, and with similar action on December 7, 1928, of the Central Committee on Lumber Standards, acting with the delegated authority of the General Conference, the United States Department of Commerce, through the Bureau of Standards, recommends that recognized classifications, nomenclature, basic grades, seasoning standards, description, measurement, tally, shipping provisions, grade marking, tally cards, sizes, uniform workings, and inspection of lumber be established as follows:

1. To the extent to which differences in quality of timber, in conditions of manufacture, and in the uses to which the product is put, will, in practical application, permit the basic provisions for the grading of lumber shall be uniform.

I. LUMBER CLASSIFICATIONS.

2. For the purposes of simplification of sizes and grades, and of equalizing, among species used for similar general purposes, the grades of a similar name, **lumber** shall be classified by principal uses into (a) yard lumber, (b) structural material, (c) shop and factory lumber.

1. Use Classification.

3. Lumber is the product of the saw and planing mill not further manufactured than by sawing, resawing, and passing lengthwise through a standard planing machine, cross-cut to length and matched.

4. Lumber is classified as (a) yard lumber, (b) structural material, and (c) factory and shop lumber. Different grading rules may apply to each class of lumber.

(a) **Yard Lumber:** Lumber that is less than 5 inches in thickness and is intended for general building purposes. The grading of yard lumber is based upon the use of the entire piece.

(b) **Structural Material:** Lumber that is 5 inches or over in thickness and width. The grading of structural material is based upon the strength of the piece and the use of the entire piece. (See footnote.)

Note: Dimension (Planks and Joists) to be used where working stresses are required should be considered and graded as structural material. (See IV Structural Material, pp—— to——).

(c) **Factory and Shop Lumber:** Lumber intended to be cut up for use in further manufacture. It is graded on the basis of the percentage of the area which will produce a limited number of cuttings of a specified or of a given minimum size and quality.

2. Size Classification.

Yard Lumber.

5. (a) **Strips:** Yard lumber less than 2 inches thick and under 8 inches wide.

(b) **Boards:** Yard lumber less than 2 inches thick, 8 inches or over in width.

(c) **Dimension:** All yard lumber except boards, strips, and timbers; that is, yard lumber 2 inches and under 5 inches thick, and of any width.

(1) **Planks:** Yard lumber 2 inches and under 4 inches thick and 8 inches and over wide.

(2) **Scantlings:** Yard lumber 2 inches and under 5 inches thick and under 8 inches wide.

(3) **Heavy Joists:** Yard lumber 4 inches thick and 8 inches or over wide.

Structural Material.

(d) **Timbers:** Lumber 5 inches or larger in least dimension.

3. Manufacturing Classification.

6. Manufactured lumber is classified as (a) rough, (b) surfaced, and (c) worked.

(a) **Rough Lumber:** Undressed as it comes from the saw.

(b) **Surfaced Lumber:** Lumber that is dressed by running through a planer. It may be surfaced on one side (S1S), two sides (S2S), one edge (S1E), two edges (S2E) or a combination of sides and edges (S1S1E), (S2S1E), (S1S2E), or (S4S).

(c) **Worked Lumber:** Lumber which has been run through a matching machine, stick-er, or molder. Worked lumber may be (1) matched, (2) shiplapped, or (3) patterned.

(1) **Matched Lumber:** Lumber that is edge dressed and shaped to make a close tongue and groove joint at the edges or ends when laid edge to edge or end to end.

(2) **Shiplapped Lumber:** Lumber that is edge dressed to make a close rabbetted or lapped joint.

(3) **Patterned Lumber:** Worked lumber that is shaped to a patterned or molded form.

II. NOMENCLATURE OF COMMERCIAL SOFTWOODS.

7. The standard commercial names for lumber cut from the principal species of softwoods, as shown in Appendix A on page 491, shall be used in the formulation of lumber grading rules and in the construction of contracts and the terms of purchase and sale of American standard lumber.

III. YARD LUMBER.

8. The term "yard lumber" as here used means lumber that is manufactured and classified into those sizes, shapes, and qualities required for ordinary construction and general purpose uses. (Heavy material for structural purposes, softwood material for shop lumber, hardwood factory lumber, and other special-use materials are not considered yard stock.)

1. Grade Standards.

9. On the basis of quality yard lumber is divided into two main divisions: (a) Select lumber and (b) Common lumber. These are again divided into two classes: Select lumber into (1) that suitable for natural finishes and (2) that suitable for paint finishes. Common lumber into (1) that which can be used without waste and (2) that which permits some waste. Each of these four classes is further divided into quality classes or grades.

Select Lumber.

10. Lumber which is generally clear, containing defects limited both as to size and number, and which is smoothly finished and suitable for use as a whole for finishing purposes or other uses in which large, clear pieces are required, shall be considered as **select lumber**.

11. Two classes shall be recognized. The first shall be suitable for natural finishes. The second class permits similar defects, and in addition, blemishes of somewhat greater extent than those of the first class, but of a type which can be covered by paint.

Grade names: A, B, C, and D.

Common Lumber.

12. Lumber containing numerous defects and blemishes which preclude it from use for finishing purposes, but which is suitable

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for general utility and construction purposes, shall be considered **common lumber**.

13. Two general classes shall be recognized. The first shall be suitable for use as a whole for purposes in which surface covering or strength is required. Defects and blemishes permitted in this class must be sound. The second class permits very

coarse defects which may cause waste in the use of the piece.

Grade names: No. 1 Common, No. 2 Common, No. 3 Common, No. 4 Common, and No. 5 Common.

Dimension grade names: No. 1 Common, No. 2 Common, and No. 3 Common.

14. Basic Grade Classification for Yard Lumber.

Total products of a typical log arranged in series according to quality as determined by appearance.

SELECT.	Lumber of good appearance and finishing qualities.	Suitable for natural finishes.	Grade A—Practically free from defects.
		Suitable for paint finishes.	Grade B—Allows a few small defects or blemishes.
COMMON.	Lumber containing defects or blemishes which detract from finish appearance but which is suitable for general utility and construction purposes.	Lumber suitable for use without waste.	Grade C—Allows a limited number of small defects or blemishes that can be covered with paint.
			Grade D—Allows any number of defects or blemishes which do not detract from a finish appearance, especially when painted.
		Lumber permitting waste.	No. 1 Common—Sound and tight knotted stock. Size of defects and blemishes limited. May be considered water-tight lumber.
			No. 2 Common—Allows large and coarse defects. May be considered grain-tight lumber.
			No. 3 Common—Allows larger and coarser defects than No. 2 and occasional knot holes.
			No. 4 Common—Low quality lumber admitting the coarsest defects such as decay and holes.
			No. 5 Common—Must hold together under ordinary handling.

Definitions of Defects and Blemishes.

15. The defects and blemishes, enumerated in the rules for grading yard lumber of any species under the American Lumber Standards, shall be defined within the limits of the "Definitions of Maximum Defects and Blemishes" as shown on page 491, Appendix B.

General Provisions.

16. The grading of lumber cannot be considered an exact science, because it is based on a visual inspection of each piece and on the judgment of the grader. The provisions of these specifications, however, are sufficiently explicit to establish 5 per cent below grade as a reasonable variation between graders.

17. All yard lumber is graded with reference to its suitability for general use as yard lumber. With this in view, each piece is considered and its grade determined by its general character, including the location and sum of all of its defects and blemishes. Material not conforming to standard sizes or grades shown herein and that intended for special uses shall be covered by special contract and inspection.

18. Except in dimension, the grade of yard lumber, rough or surfaced two sides, shall be determined from the better or face side of the piece, and lumber which is surfaced one side only shall be graded from the surfaced side.

19. The rules for yard lumber prescribe the number and extent of defects and blemishes permitted in the poorest pieces admissible in each grade. A grade should be representative, however, and not made up of only low line pieces.

20. The number of defects and blemishes permitted varies as the area of the piece to be graded increases or diminishes in respect to the basic size or area specified, but the size of the defects must not exceed that allowed by the grading rules.

21. When defects or blemishes, or combinations thereof, not described in these grading rules are encountered, they will be considered as equivalent to known defects according to their damaging effect upon the piece in the grade under consideration.

22. Equivalent means equal, and in constructing and applying these rules, the defects and blemishes allowed, whether specified or not, are understood to be equivalent in damaging effect to those mentioned as applying to the stock under consideration.

23. Imperfections in rough stock which can be removed in dressing to standard size shall not be considered in determining the grade under these rules.

24. Defects and blemishes admissible in rough stock shall be the same as those applying to dressed stock of like kind and grade, and in addition, such other defects and blemishes as will disappear in dressing such stock to standard sizes shall be allowed.

25. Material shall be considered edge grain (vertical grain) when the rings (so-called grain) form an angle of 45° or more with the surface of the piece. When the angle becomes less than 45° at any point, the material shall be known as flat (slash) grain.

26. Mixed grades other than the two highest recognized grades for each species, not specifying the proportion of each grade, are not American Standard grades.

Lumber Seasoning.

27. Specifications dealing with lumber seasoning and moisture content shall be developed by each regional manufacturers association in accordance with its own conditions and the requirements of the users of its products. Such specifications adopted from time to time by any regional association shall be filed with the Central Committee on Lumber Standards for approval.

2. YARD AND INDUSTRIAL SIZE STANDARDS.

Basis of Measurement of Sizes.

28. The dressed dimensions, specified in paragraphs 30 to 33 inclusive, and the rough sizes specified in paragraphs 34 to 36 inclusive, shall apply to lumber in the condition of seasoning as sold and shipped.

Dressed Sizes.

29. The terms "standard yard board" and "standard industrial board," and "standard yard dimension" and "standard industrial dimension" shall be the designations for 1-inch boards and 2-inch dimension, respectively.

30. 25/32 inch, S1S or S2S shall be the thickness for the standard yard board; 26/32 inch, S1S or S2S, for the standard industrial board.

31. 1½ inches, S1S or S2S shall be the thickness for standard yard dimension not more than 12 inches wide; 1¾ inches, S1S or S2S, for standard industrial dimension.

32. The finished widths of finish S1E or S2E shall be ¾ inch off on lumber of standard width of 3 inches; the finished widths of finish S1E or S2E (based on kiln dried lumber) shall be ½ inch off on lumber of standard widths of 4 to 7 inches, inclusive, and ¼ inch off on lumber of standard widths of 8 to 12 inches inclusive; and the finished widths of boards



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and dimension S1E or S2E shall be $\frac{3}{8}$ inch off on lumber of standard widths less than 8 inches and $\frac{1}{2}$ inch off on lumber of standard widths of 8 to 12 inches.

33. The thicknesses and widths of finished lumber, S1S or S2S, and/or S1E or S2E, shall be as follows:

Tables of sizes, methods of lumber measurement, shipping and other provisions included in the recommendations of December, 1923, and amended May 1, 1925, April 27, 1926, May 3, 1928, and December 7, 1928, are published under miscellaneous information in the back of this book.

Rough Dry Sizes.

34. The standard rough dry thickness of the standard yard board shall be not less than $\frac{3}{4}$ inch with an allowance of 20 per cent of the shipment, which may be not less than $\frac{23}{32}$ inch, and the standard rough dry thickness of the standard industrial board shall be not less than $\frac{30}{32}$ inch with an allowance of 10 per cent of the shipment, which may be not less than $\frac{3}{8}$ inch.

35. The standard rough dry thickness of finish, common boards, and dimension of standard sizes $1\frac{1}{4}$ inches and thicker, board measure, shall be not less than $\frac{1}{2}$ inch thicker than the corresponding standard finished dry thickness, with an allowance of 20 per cent of the shipment, which may be not less than $\frac{5}{8}$ inch thicker than the corresponding standard finished dry thickness.

36. The standard rough dry width of finish of 3 inch width, board measure, shall be not more than $\frac{1}{4}$ inch less than the nominal width; the standard rough kiln dried widths of finish of widths 4 to 7 inches, inclusive, board measure, shall be not more than $\frac{3}{8}$ inch less than the nominal widths, and widths 8 to 12 inches, inclusive, board measure shall be not more than $\frac{5}{8}$ inch less than the nominal widths; and the standard rough dry widths of common boards and dimension, 7 inches and narrower, board measure, shall be not more than $\frac{1}{4}$ inch less than the nominal widths, and the widths 8 to 12 inches, board measure, shall be not more than $\frac{3}{8}$ inch less than the nominal widths.

Lengths.

37. With the exception of the following enumerated odd lengths, which shall be standard, odd lengths in yard lumber and in structural material shall not be considered in the American Lumber Standards.

2 by 4 inches, 6 and 8 inches—9 and 11 feet.

2 by 8 inches and 10 inches—13 feet.

2 by 10 inches—15 feet.

8 by 8 inches, 10 by 10 inches, 19 by 12 inches, 12 by 12 inches, 14 by 14 inches, 16 by 16 inches, 18 by 18 inches—11 and 13 feet.

6 by 16 inches, 6 by 18 inches, 8 by 16 inches, 8 by 18 inches—15 and 17 feet.

38. The marketing practice covering lengths of yard lumber shall permit the buyer to secure specified lengths and/or specified assortments of lengths.

WORKINGS.

39. The standard workings of flooring, ceiling, partition, drop siding, and rustic, surfaced two sides and center matched, shiplap, heavy flooring, grooved for splines, and Byrkit Lath, as shown in Appendix C of Simplified Practice Recommendation No. 16, U. S. Department of Commerce, 4th Edition, shall be considered **standard**. All other workings shall be considered **special**.

MOLDINGS

41. The "standard designs and universal sizes" of wood moldings, as shown in Appendix D of Simplified Practice Recommendation No. 16, U. S. Department of Commerce, 4th Edition, shall be considered **standard**. All other designs and sizes shall be considered **special**.

APPENDIX A

STANDARD COMMERCIAL NAMES FOR LUMBER CUT FROM THE PRINCIPAL SPECIES OF SOFTWOODS.

The following Standard Commercial Names for lumber cut from the principal species of softwoods shall be used in the construction of contracts and other documents arising in transactions of purchase and sale of American Standard lumber. Preferred commercial names are shown in **bold face type**.

Standard Commercial Name Botanical Name Cedars and Junipers

Alaska Cedar	Chamaecyparis nootkensis
Eastern Red Cedar...	Juniperus virginiana
	Juniperus lucayana
	(southern red cedar)
	Juniperus mexicana
	(mountain juniper)
Incense Cedar	Libocedrus decurrens
Northern White Cedar	Thuja occidentalis
Port Orford Cedar	Chamaecyparis lawsoniana
Southern White Cedar	Chamaecyparis thyoides
Western Red Cedar ..	Thuja plicata
Western Juniper	Juniperus utahensis
	(Utah juniper)
	Juniperus pachyphloea
	(alligator juniper)
	Juniperus scopulorum
	(Rocky Mt. red cedar)
	Juniperus occidentalis
	(western juniper)

Cypress

Red Cypress (Coast type)	Taxodium distichum
Yellow Cypress (Inland type)	Taxodium distichum
White Cypress (Inland type)	Taxodium distichum

Douglas Fir

Douglas Fir (Coast type)	Pseudotsuga taxifolia.
Red Fir (Intermountain type)	Pseudotsuga taxifolia.
Red Fir (Rocky Mountain type)	Pseudotsuga taxifolia.

The True Firs

Alpine Fir	Abies lasiocarpa
Balsam Fir	Abies balsamea and
	Abies fraseri (southern balsam fir)
Golden Fir	Abies magnifica
Noble Fir	Abies nobilis
Silver Fir	Abies amabilis
White Fir	Abies concolor and
	Abies grandis (lowland white fir)

Hemlocks

Eastern Hemlock	Tsuga canadensis and
	Tsuga caroliniana
	(Carolina hemlock)
Mountain Hemlock ..	Tsuga mertensiana
West Coast Hemlock ..	Tsuga heterophylla

Larch

(See also Tamarack)

Western Larch	Larix occidentalis
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Pines

Arkansas Soft Pine ..	Pinus echinata and
	taeda
California White Pine	Pinus ponderosa and
	Pinus jeffreyi (Jeffrey pine)
Idaho White Pine	Pinus monticola
Jack Pine	Pinus banksiana
Loblolly Pine	Pinus taeda
Lodgepole Pine	Pinus contorta
Longleaf Pine	Pinus palustris
North Carolina Pine ..	Pinus taeda and echinata, and Pinus virginiana (Virginia pine)
Northern White Pine ..	Pinus strobus
Norway Pine	Pinus resinosa
Pond Pine	Pinus rigida serotina
Pondosa Pine	Pinus ponderosa



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Shortleaf Pine	<i>Pinus echinata</i>
Slash Pine	<i>Pinus caribaea</i>
Southern Pine	<i>Pinus taeda</i> , <i>palustris</i> , <i>serotina</i> , <i>echinata</i> , and <i>caribaea</i> , and <i>Pinus rigida</i> (pitch pine), and <i>Pinus</i> <i>glabra</i> (spruce pine)
Sugar Pine	<i>Pinus lambertiana</i>
Redwood	
.....	<i>Sequoia sempervirens</i>
Spruces	
Eastern Spruce	<i>Picea mariana</i> (black spruce), <i>Picea rubra</i> (red spruce), and <i>Picea glauca</i> (white spruce)
Engelmann Spruce ..	<i>Picea engelmanni</i> and <i>Picea parryana</i> (blue spruce)
Sitka Spruce	<i>Picea sitchensis</i>
Tamarack	
.....	<i>Larix laricina</i>
Yew	
Pacific Yew	<i>Taxus brevifolia</i>

APPENDIX B

DEFINITIONS OF MAXIMUM DEFECTS AND BLEMISHES

1. A **defect** is defined as any irregularity occurring in or on wood that may lower some of its strength, durability, or utility values.

2. A **blemish** is defined as anything, not classified as a defect, marring the appearance of the wood.

The commonly recognized defects and blemishes occurring in yard lumber are (names of species manufactured)

Bark pockets.	Pitch.
Bird's-eye.	Pitch pockets.
Checks.	Pitch seams.
Cross-breaks.	Pitch streaks.
Cross-grain.	Pith.
Decay.	Pith flecks.
Gum spots or streaks.	Shake.
Holes.	Splits.
Imperfect manufacture.	Stain or discoloration.
Knots.	Wane.
	Warp.

Bark Pockets.

3. A **bark pocket** is a patch of bark partially or wholly enclosed in the wood. In size it is classified the same as pitch pockets.

Bird's-eye.

4. "Bird's-eye" is a small central spot with the wood fibres arranged around it in the form of an ellipse, so as to give the appearance of an eye. "Bird's-eye," unless unsound or hollow, shall not be considered a defect.

Checks.

5. A **check** is a lengthwise separation of the wood, which occurs usually across the rings of annual growth.

6. A **surface check** is a check occurring on the surface of the piece.

7. A **small surface check** is a perceptible opening not over 4 inches long.

8. A **medium surface check** is one not over $\frac{1}{2}$ inch wide and over 4 but not more than 10 inches long.

9. A **large surface check** is one over $\frac{1}{2}$ inch wide and over 10 inches long.

10. An **end check** is one occurring on an end of a piece.

11. A **through check** is one extending from one surface through the piece to the opposite surface or to an adjoining surface.

12. A **heart check** is one starting at the pith and extending toward but not to the surface of a piece.

Cross Breaks.

13. A **cross break** is a separation of the wood cells across the grain, such as may be due to tension resulting from unequal shrinkage or mechanical stresses.

Cross Grain.

14. **Cross grained wood** is that in which the cells or fibres do not run parallel with the axis, or sides, of a piece.

15. **Slight cross grain** is a slope of the grain not over 1 inch in a length of 15 inches.

16. **Medium cross grain** is a slope of the grain over 1 inch in a length of 15 inches but not more than 1 inch in a length of 10 inches.

17. **Steep cross grain** is a slope of the grain over 1 inch in a length of 10 inches.

Decay.

18. **Decay** is a disintegration of the wood substance due to the action of wood-destroying fungi. The words *dote* and *rot* mean the same as decay.

19. **Incipient decay** is the early stage of decay in which the disintegration has not proceeded far enough to soften or otherwise change the hardness of the wood perceptibly. It is usually accompanied by a slight discoloration or bleaching of the wood.

20. **Firm red heart** is a stage of incipient decay characterized by a reddish color produced in the heartwood, which does not unfit the wood for the majority of yard purposes.

21. **Water-soak (or stain)** is a term applied to a generally water-soaked area in heartwood, which is usually interpreted as the incipient stage of certain wood rots.

22. **Advanced (or typical) decay** is the older stage of decay in which the disintegration is readily recognized because the wood has become punky, soft and spongy, stringy, ring-shaked, pitted, or crumbly. Decided discoloration or bleaching of the rotted wood is often apparent.

23. A **pocket rot** is typical decay which appears in the form of a hole, pocket, or area of soft rot, usually surrounded by apparently sound wood.

Gum Spots and Streaks.

24. A **gum spot or streak** is an accumulation of gum-like substance occurring as a small patch or streak in a piece. It may occur in conjunction with a bird peck, or other injury to the growing wood. In size they are classified the same as pitch pockets or pitch streaks.

Holes.

25. **Holes** in wood may extend partially or entirely through the piece and be from any cause.

26. When **holes** are permitted, the average of the maximum and minimum diameters measured at right angles to the direction of the hole shall be used in measuring the size, unless otherwise stated.

27. A **pin worm hole** is one not over $\frac{1}{16}$ inch in diameter.

28. A **medium worm hole** is one over $\frac{1}{16}$ inch but not more than $\frac{1}{4}$ inch in diameter.

29. A **large worm hole** is one over $\frac{1}{4}$ inch in diameter.

Imperfect Manufacture.

30. **Imperfect manufacture** includes all defects or blemishes which are produced in manufacturing, such as chipped grain, loosened grain, raised grain, torn grain, skips in dressing, hit and miss, variation in sawing, miscut lumber, machine burn, machine gouge, mismatching, and insufficient tongue or groove.

31. **Chipped grain** means that a part of the surface is chipped or broken out in very short particles below the line of cut. It should not be classed as torn grain and, as usually found, shall not be considered a de-



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fect, unless it is present in excess of 25 per cent of the area.

32. **Loosened grain** means that a small portion of the wood has become loosened but not displaced.

33. **Raised grain** is a roughened condition of the surface of dressed lumber in which the hard summerwood is raised above the softer springwood, but not torn loose from it.

34. **Torn grain** means that a part of the wood is torn out in dressing, and in depth is of four distinct characters; slight, medium, heavy, and deep.

35. **Slight torn grain** is not over $\frac{1}{32}$ inch in depth.

36. **Medium torn grain** is over $\frac{1}{32}$ but not more than $\frac{1}{16}$ inch in depth.

37. **Heavy torn grain** is over $\frac{1}{16}$ but not more than $\frac{1}{8}$ inch in depth.

38. **Deep torn grain** is over $\frac{1}{8}$ inch in depth.

39. A **skip** is an area on a piece that failed to surface.

40. A **sight skip** is one that failed to surface smoothly, whose area does not exceed the product of the width of the piece in inches multiplied by 6.

41. A **heavy skip** is one that the planer knife did not touch.

42. **Hit and miss** is a series of skipped spots with surfaced areas between, or with skips the entire length when not over $\frac{1}{16}$ inch in depth.

43. **Variation in sawing** is a deviation from the line or cut. Slight variation is not more than $\frac{1}{16}$ inch in one-inch material, $\frac{1}{8}$ inch in 2-inch, $\frac{3}{16}$ inch in 3 to 4-inch, and $\frac{1}{4}$ inch in 8 inches and up.

44. **Miscut lumber** is that which has a greater variation in thickness or width at different places on the piece than specified for variation in sawing.

45. A **machine burn** is a darkening or charring of the wood due to overheating by the machine knives.

46. A **machine gouge** is a groove across a piece due to the machine cutting below the desired line of cut.

47. **Mismatched material** is worked material that does not fit tightly at all points of contact between adjoining pieces, or in which the surfaces of adjoining pieces are not in the same plane.

48. **Slight mismatch** is a surface variation not over $\frac{1}{64}$ inch.

49. **Medium mismatch** is a surface variation over $\frac{1}{64}$ but not more than $\frac{1}{32}$ inch.

50. **Heavy mismatch** is a surface variation over $\frac{1}{32}$ inch.

Knots.

51. A **knot** is a branch or limb embedded in the tree which has been cut through in the process of lumber manufacture. Knots are classified according to size, form, quality, and occurrence.

52. The average of the maximum and minimum diameters shall be used in measuring the size of knots, unless otherwise stated.

Size.

53. A **pin knot** is one not over $\frac{1}{2}$ inch in diameter.

54. A **small knot** is one over $\frac{1}{2}$ inch but not more than $\frac{3}{4}$ inch in diameter.

55. A **medium knot** is one over $\frac{3}{4}$ inch but not more than $1\frac{1}{2}$ inches in diameter.

56. A **large knot** is one over $1\frac{1}{2}$ inches in diameter.

Form.

57. A **round knot** is one oval or circular in form.

58. A **spike knot** is a branch or limb sawed in a lengthwise direction.

Quality.

59. A **sound knot** is solid across its face, as hard as the surrounding wood, and shows

no indications of decay. It may vary in color from red to black.

60. An **unsound knot** is solid across its face, but contains incipient decay.

61. A **decayed knot** is softer than the surrounding wood and contains advanced decay.

62. A **tight knot** is one so fixed by growth or position that it will firmly retain its place in the piece.

63. An **intergrown knot** is one whose rings of annual growth are completely intergrown with those of the surrounding wood.

64. A **watertight knot** is one whose rings of annual growth are completely intergrown with those of the surrounding wood on one surface of the piece, and which is sound on that surface.

(Note: Definitions for sound, tight, intergrown, or watertight knots may be combined in one or more definitions.)

65. An **encased knot** is one whose rings of annual growth are not intergrown and homogeneous with those of the surrounding wood. The encasement may be partial or complete; or pitch or bark.

66. A **"not firm" knot** is one which under ordinary conditions will hold its place in a dry board and yet under pressure can be started but not easily pushed out of the piece.

67. A **loose knot** is one not held firmly in place by growth or position and cannot be relied upon to remain in place in the board.

68. A **pith knot** is a sound knot with a pith hole not more than $\frac{1}{4}$ inch in diameter.

69. A **hollow knot** is an apparently sound knot with a relatively large hole in it.

Occurrence

70. A **single knot** is one occurring by itself with the fibers of the wood in which it occurs deflected around it.

71. A **knot cluster** is two or more knots grouped together as a unit with the fibres of the wood deflected around the entire unit. A group of single knots is not a knot cluster.

72. **Branch knots** are two or more knots branching from a common center.

Pitch.

73. **Pitch** is a poorly defined accumulation of resin in the wood cells in a more or less irregular patch.

74. **Light pitch** is the lightly evident presence of pitch.

75. **Medium pitch** is a slightly more evident trace of pitch than is the light.

76. **Heavy pitch** is the very evident presence of pitch showing by its color and consistency.

77. **Massed pitch** is a clearly defined accumulation of solid pitch in a body by itself in a piece of lumber.

Pitch Pockets.

78. A **pitch pocket** is a well defined opening between rings of annual growth usually containing, or which has contained, more or less pitch, either solid or liquid. Bark also may be present in the pocket.

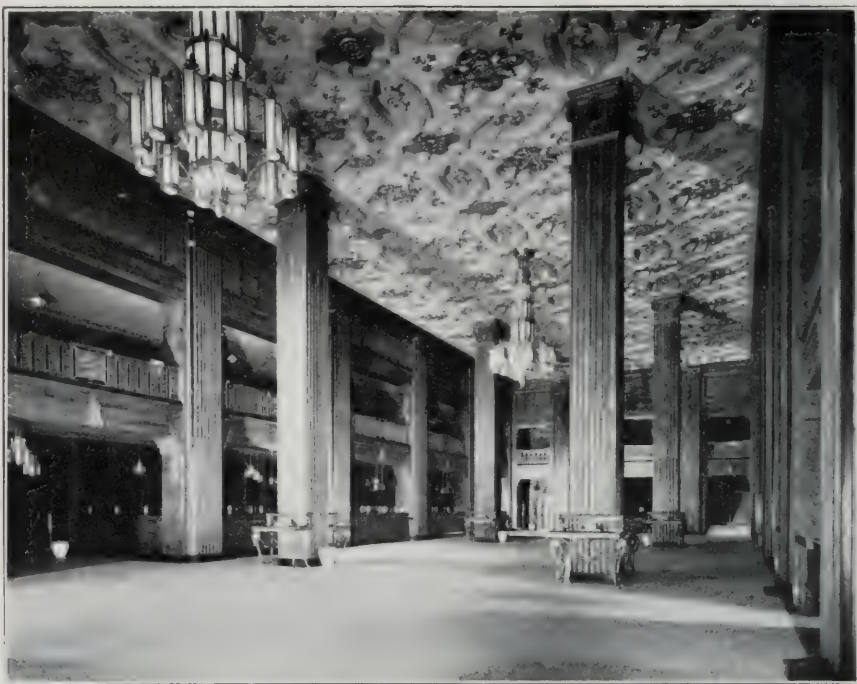
79. A **very small pitch pocket** is one not over $\frac{1}{8}$ inch in width and not over 2 inches in length.

80. A **small pitch pocket** is one not over $\frac{1}{8}$ inch in width and not over 4 inches in length, or not over $\frac{1}{4}$ inch in width and not over 2 inches in length.

81. A **medium pitch pocket** is one not over $\frac{1}{8}$ inch in width and not over 8 inches in length, or not over $\frac{3}{8}$ inch in width and not over 4 inches in length.

82. A **large pitch pocket** is one whose width or length exceeds the maximum stated as permissible for a medium pitch pocket.

83. A **closed pitch pocket** is one that does not show an opening on both sides of the piece.



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Pitch Seams.

84. A **pitch seam** is a shake or check which is filled with pitch.

Pitch Streaks

85. A **pitch streak** is a well-defined accumulation of pitch in a more or less regular streak.

86. A **small pitch streak** is one not over $\frac{1}{12}$ the width by $\frac{1}{8}$ the length of the surface on which it occurs.

87. A **medium pitch streak** is one over $\frac{1}{12}$ but not more than $\frac{1}{8}$ the width, by over $\frac{1}{8}$ but not more than $\frac{1}{3}$ the length of the surface on which it occurs.

88. A **large pitch streak** is over $\frac{1}{8}$ the width by $\frac{1}{3}$ the length of the surface on which it occurs.

Pith.

89. **Pith** is the small soft core occurring in the structural center of a log. The wood immediately surrounding the pith often contains small checks, shake, or numerous pin knots, and is discolored; any such combination of defects and blemishes is known as **heart center**.

Pith Flecks.

90. A **pith fleck** is a narrow streak resembling pith, usually brownish, up to several inches in length on the surface of a piece resulting from burrowing of larvae in the growing tissue of the tree.

Shake.

91. A **shake** is a lengthwise separation of the wood, which occurs usually between and parallel to the rings of annual growth.

92. A **fine shake** is one with a barely perceptible opening.

93. A **slight shake** is one with more than a perceptible opening but not over $\frac{1}{32}$ inch in width.

94. A **medium shake** is one with an opening over $\frac{1}{32}$ but not more than $\frac{1}{8}$ inch wide.

95. An **open shake** is one with an opening over $\frac{1}{8}$ inch wide.

96. A **through shake** is one extending from one surface through the piece to the opposite surface or to an adjoining surface.

Splits.

97. A **split** is a lengthwise separation of the wood, due to the tearing apart of the wood cells.

98. A **short split** is one whose length does not exceed either the width of a piece or $\frac{1}{6}$ its length.

99. A **medium split** is one whose length exceeds the width of a piece, but does not exceed $\frac{1}{6}$ its length.

100. A **long split** is one whose length exceeds $\frac{1}{6}$ the length of a piece.

Stain (or Discoloration).

101. **Stain** is a discoloration, occurring on or in lumber, of any color other than the natural color of the piece on which it appears. It is classified as light, medium, and heavy.

102. **Light stain** is a slight difference in color which will not materially impair the appearance of the piece if given a natural finish.

103. **Medium stain** is a pronounced difference in color which, although it does not obscure the grain of the wood, would customarily be objectionable in a natural but not in a painted finish.

104. **Heavy stain** is a difference in color so pronounced as practically to obscure the grain of the wood.

Wane.

105. **Wane** is bark, or the lack of wood or bark, from any cause, on the edge or corner of a piece.

106. **Slight wane** is not over $\frac{1}{4}$ inch wide on the surface on which it appears, for $\frac{1}{6}$ the length and $\frac{1}{4}$ the thickness of the piece.

107. **Medium wane** is over $\frac{1}{4}$ inch but not more than $\frac{1}{2}$ inch wide on the surface

on which it appears, for $\frac{1}{6}$ the length and $\frac{1}{4}$ the thickness of the piece.

108. **Large wane** is over $\frac{1}{2}$ inch wide on the surface on which it appears, and/or over $\frac{1}{6}$ the length and $\frac{1}{4}$ the thickness of the piece.

Warp.

109. **Warp** is any variation from a true or plane surface. It includes bow, crook, cup, or any combination thereof.

110. **Bow** is a deviation flatwise from a straight line drawn from end to end of a piece and is measured at the point of greatest distance from the straight line.

111. **Crook** is a deviation edgewise from a straight line drawn from end to end of a piece and is measured at the point of greatest distance from the straight line. It is known as slight, small, medium, and large.

112. Based on a piece 4 inches wide and 16 feet long, the distances for the different degrees of crook shall be: for **slight crook**, a maximum of 1 inch; **small crook**, $1\frac{1}{2}$ inches; **medium crook**, 3 inches; and **large crook**, over 3 inches. For wider pieces it shall be $\frac{1}{8}$ inch less for each additional 2 inches of width. Shorter or longer pieces may have the same curvature.

113. **Cup** is a curve in a piece across the grain or width of a piece. It is measured at the point of greatest deviation from a straight line drawn from edge to edge of a piece. It is known as slight, medium, and deep.

114. Based on a piece 12 inches wide, the distances for the different degrees of cup shall be: for **slight cup**, a maximum of $\frac{1}{4}$ inch; **medium cup**, $\frac{3}{8}$ inch; and **deep cup**, $\frac{1}{2}$ inch. Narrower or wider pieces may have the same curvature.

RECOMMENDED ARCHITECT'S DETAILED DESCRIPTION OF GRADES SUPPLEMENTAL TO "SUMMARY OF BASIC GRADE CLASSIFICATIONS FOR YARD LUMBER."

(See Sec. 14.)

The standard grades of yard stock products, such as finish, flooring, siding, boards and dimension, conform to the following basic grading specifications, with such modifications as are required by the use intended or may be permitted in the interests of conservation. Grades other than these described shall be considered special. (These grades are based on a piece 8 inches wide by 12 feet long, or a piece which contains 8 square feet, surface measure.)

GRADE A shall be free from defects on the face side of pieces to and including 12 inches in width. Widths greater than 12 inches will admit two or combination of two of any of the following defects:

Sound and tight pin knot.
Small pitch pocket.
Small surface check.
Slight crook.
Slight wane.

GRADE B shall possess natural finishing qualities but will admit two or combination of two of any of the following defects:

Medium sound and intergrown knot.
Two small knots.

Three sound and tight pin knots.
Short split.

Fine shakes; equal in length to width of piece.

Three small surface checks.
Medium wane.

Small crook.
Slight cup.

Medium pitch pocket.
Three very small pitch pockets.

Small pitch streak.

Pin worm holes, one per surface foot.

Slight discoloration; 5 per cent of area.

Firm red heart; 5 per cent of area.

Patch slight torn grain.

Slight chipped grain.



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GRADE C shall possess finishing qualities but will admit any four or combination of four of any of the following defects:

Medium sound and intergrown knot.
Small encased knot.
Three sound and tight pin knots.
Short split.
Fine shake; equal in length to width of piece.
Three small surface checks.
Medium wane.
Small crook.
Slight cup.
Medium pitch pocket.
Three very small pitch pockets.
Medium pitch streak.
Pin worm holes; 2 per surface foot.
Medium discolorations: 10 per cent of area.
Firm red heart; 10 per cent of area.
Pith. 3 inches in length.
Patch medium torn grain.
Slight skip.

GRADE D shall be of select common quality and possess a finishing appearance but will admit any number of the following defects and blemishes. More serious defects shall be permitted on the reverse side, but no combination so serious as to prevent its use for the purpose intended.

Medium sound and intergrown knot.
Small encased knot.
Short split.
Fine shake.
Medium surface check.
Medium wane.
Small crook.
Slight cup.
Medium pitch pocket.
Medium pitch streak.
Pin worm holes; 2 per surface foot.
Medium discoloration: 10 per cent of area.
Firm red heart; 10 per cent of area.
Pith. 3 inches in length.
Patch medium torn grain.
Slight skip.

Pieces containing one serious defect, such as loose knot or knot hole located more than 32 inches from either end, but which may be cut out with a loss no greater than 3 inches in length, may be permitted, provided the rest of the piece is of B or better quality.

No. 1 Common shall present a generally smooth appearance and be high class general utility lumber. It permits any number of the following defects not in serious combination:

Sound and intergrown knots: 1½ inches in diameter in 4-inch and 6-inch widths, 2 inches in 8-inch and 10-inch, 2½ inches in 12-inch and not over 3 inches in wider widths.

Black and encased knots: one-half the diameter of sound and intergrown knots permitted up to a maximum diameter of 1¼ inches, provided the knot be sound and immovably fixed in position.

Short split.
Slight shake that does not go through; equal in length to width of piece.

Surface checks.
Medium wane.
Small crook.
Medium cup.

Large pitch pockets which do not show an opening through the piece.
Large pitch streak.
Pitch.

Pin worm holes not exceeding 12 per surface foot if well scattered.
Medium discoloration.

Firm red heart.
Pith one-sixth the length of piece.
Patch heavy torn grain.
Slight skip.

Medium cross grain.

No. 2 Common permits any number of the following defects, but no combination of them so serious as to prevent the use of each piece as a whole, except as noted:

Sound and tight knots: 2½ inches in diameter in 4 and 6-inch widths, 3 inches in 8 and 10-inch, 3½ inches in 12-inch, and not over 4 inches in wider widths.

Unsound and pith knots, provided the knot be fixed in position.

Spike or branch knots; which are sound and do not weaken the piece at any point more than the knots heretofore specified.
Splits not more than ¼ the length of the piece.

Through check or shake; ½ the length of the piece.

Large wane.

Medium crook.

Large cup.

Large through pitch pockets; which do not show an opening greater than ½ inch wide by 3 inches in length.

Large pitch streak.

Pitch.

Small grub worm holes; maximum of one per surface foot.

Pin worm holes.

Slight peck.

Heavy discoloration.

Firm red heart.

Streak of advanced decay, not going through the board, equal in area to a streak ½ inch wide by 1/6 the length of piece.

Pith.

Deep torn grain.

Slight skips.

Large cross grain.

Pieces containing a loose knot or a knot hole not more than 2 inches in diameter may be permitted, provided the rest of the piece is of No. 1 Common quality.

No. 3 Common permits all defects and blemishes allowed in No. 2 Common but to a greater degree. It shall be suitable for use as a whole.

No. 4 Common. The defects common to this grade are much the same as those found in No. 3, but exist to a greater degree. The most common serious defects are knot holes, either red rot or its equivalent, in heavy massed pitch, or serious check. Other types are extremely coarse knotted, waney, excessive heart shake, badly split or badly checked pieces.

No. 5 Common is the lowest recognized grade and admits all defects known in lumber, provided the piece is strong enough to hold together when carefully handled.

SIMPLIFIED PRACTICE RECOMMENDATION.

7. SHINGLES.

Grades.

60. The basic grades of shingles shall be A, B, C, and D. The grade name shall be clearly marked on each and every bundle of wood shingles.

Sizes.

61. 16-inch 6/2 shingles and 18-inch 5/2 shingles shall be eliminated.

62. Dimension shingles shall be sold full net count, no dimension shingle to be less than ½ inch scant of the specified width when dried.

Shipping Provisions.

63. The kiln-dried weight of shingles shall be not more than 10 per cent under the present association shipping weights.

64. The openings shall not exceed an average of 1 inch to the course in random-width shingles.

Specifications for Red Cedar Shingles.

Specifications for Standard Grades of Red Cedar shingles, 24"-4/2", 18"-5/2¼" and 16"-5/2", random width are as follows:

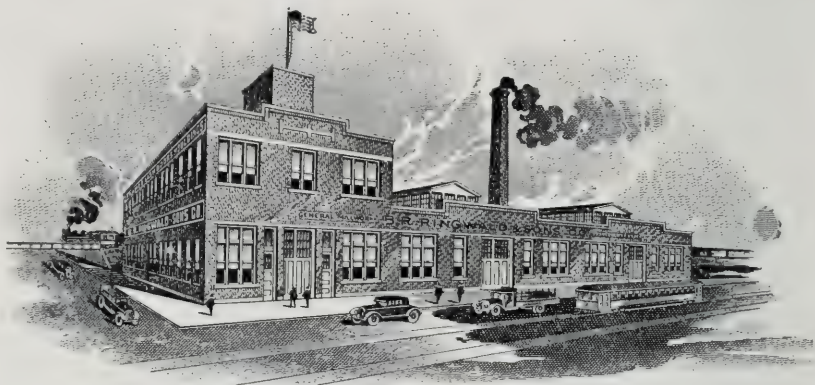
A—Strictly clear, edge grain, and free from sap.

B—Strictly clear, mixed edge grain and flat grain, not more than ½" sap, within 5" from butt, on one edge only.

C—10-inch clear butts and better for 16 and 18" shingles, and 16-inch clear butts and better for 24-inch shingles not permitted in higher grades. Sap permitted.

D—6-inch to 10-inch clear butts. Sap permitted.

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Structural Grades of Lumber and Timber and the Method of Their Development.

H1. The purpose of structural grades is to offer means for selecting structural material for strength, and for assured minimum strength, in order that appropriate working stresses may be assigned.

H2. The most important factors which influence the strength of structural material are the size, number and location of defects, and the extent of exposure to moisture during use.

H3. Structural grades control defects by limiting their size and location in accordance with their effect upon strength. Working stresses for each species are recommended by the Forest Products Laboratory, U. S. Forest Service, and take into consideration the allowable defects, the moisture content as determined by conditions of use, and, in the case of southern pine and Douglas fir, rate of growth and percentage of summer-wood.

H4. Moisture affects the strength of structural members both directly and indirectly. The direct effect of loss of moisture is the stiffening and strengthening of the wood fibers. This increase in strength, however, is accompanied by checking, splitting, warping and twisting; as a consequence, some of the strength due to drying is lost. The strength of green wood is therefore used as the basis of working stresses.

H5. In dimension sizes four inches and less in thickness the development of defects during seasoning does not offset the increase in strength from drying as much as in larger sizes, and in these sizes used in dry locations, greater defects can be permitted with the same working stresses in extreme fiber in bending.

H6. During use, construction material is subject to varying conditions of moisture, from the dry location of a heated building, to the continually wet condition of some pier and dock timbers. These conditions must be taken into account in recommending working stresses.

H7. The principal defects which must be limited in structural grades are: Knots, Shakes and Checks, and Slope of Grain.

H8. The influence of a knot in a beam is determined by its location, and the area of its projection on the cross section of the piece, the method of measurement being such as to give the best approximation of this influence.

Knots in posts and large beams are likely to show only on one face or to run diagonally through the piece, and reduce the strength in practically direct proportion to their size as measured. In dimension sizes, the knot is likely to run directly through the piece, and the strength when used on edge, as for joist, as affected by a knot on a wide face is measured by the square of the effective depth of the face, assuming the knot in its worst position, near the edge of the piece. The reduction in strength due to the knot is approximately twice the ratio of the size of the knot to the width of the face. On narrow faces, and center lines of wide faces of dimension sizes used on edge as joist, and on material used flat, as plank, the influence of a knot is directly proportional to the size, as in posts and large beams.

H9. Knot limitations on edges of wide faces of dimension sizes, for use as joist, are more severe than would be required for use flat, as plank, the sizes applying along the center lines of the wide faces as joist being those which could theoretically apply at any point across the width if used only as plank. It has been found, however, that under practically all conditions of use, knots along the edges of planks are more objectionable than knots along the center lines and this is

recognized in some commercial yard grades of plank in a stricter limitation of knots along the edges of wide faces than along the center lines. The same knot limitations are applied, therefore, to material to be used either as joist or plank, and the same working stresses are assigned for use either on edge or flat.

H10. In both joists and beams, knots reduce strength most along the top and bottom edges, through the center portion. The sizes of knots permitted in various portions of a joist or beam are limited in accordance with the stresses, and they are allowed to increase toward the ends and toward the center lines of the vertical faces, no knot, however, being permitted of more than double the size allowed at the point of maximum stress.

H11. There is greater proportional distortion of grain around a large knot than around a smaller one, and shrinkage in seasoning causes greater internal stresses, so knot sizes are increased proportionately to width of faces only up to 6-inch top and bottom faces of beams. 12-inch vertical faces of beams, and 12-inch faces of dimension and posts. Beyond these widths of face, increase is proportional to the square root of the ratio of the wider faces to these widths.

The distribution and aggregate diameter of knots is limited, as well as the maximum size of the single knot. The aggregate diameter of all knots in the center half of the length on any face of a Beam or Stringer is limited, in direct proportion of increase from none in clear wood to an aggregate diameter of twice the width of the face in a grade having 50 per cent of the strength of clear wood.

In Joist and Plank, in dry locations, the aggregate diameter of knots in the center half of the length of any face may be greater by one-half the width of the face than the aggregate diameter permitted in Beams and Stringers.

In Posts and Columns, the aggregate diameter of all knots in any 6 inches of length, in any grade, is limited to twice the size of the maximum knot allowable.

H12. In joist and plank, the mean or average diameter of a knot is taken as its size. In such thin and relatively wide material, whether used on edge or flat, this is a safe measure of the influence of knots on strength, and has the commercial advantage of being directly applicable to yard grades of lumber. This method of measurement will exclude damaging spike knots, and can be applied to them as well as to round or oval knots.

H13. On the top or bottom of a beam, the influence of knots is measured largely by the surface fibers cut. The projection of the knot on a line at a right angle to the edge is, therefore, used.

On the vertical face of a beam, the depth to which a knot penetrates is of great importance, while the influence of the number of surface fibers cut, and the amount of grain distortion, is considerably less important than on the horizontal faces. The smallest diameter of the knot is, therefore, used. One of the best examples illustrating the reason for the smallest diameter being taken on the vertical face is the splitting of a boxed heart timber into two pieces. The long spike knots which might be opened up in this way would be no more injurious to the strength of the two pieces than they would as a single knot in a boxed heart piece, and the two pieces so cut would be less subject to seasoning checks than a boxed heart piece.

H14. In columns there are two factors: area of cross section occupied by a knot, which would probably be measured best by the small diameter of the knot, and the influence of bending stresses when the column begins to fail, probably measured best by the projection of the knot. In short columns, the area of the cross section is of primary importance; as the column gets longer, the



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factor of bending strength increases in importance until the condition of the Euler formula is reached, when stiffness, on which knots have practically no influence, becomes the ruling factor. The average diameter, therefore, is used as that which applies best to the average condition.

H15. In grades for structural use: no distinction is made between intergrown knots and encased knots or knotholes, observation at the Forest Products Laboratory in recent tests having shown that intergrown knots reduce strength fully as much as encased knots or knotholes.

H16. Shakes reduce the area of a beam acting in resistance to shear, and the limitations placed on shake in such material are based on this reduction. Checks are limited on the same basis as shakes, and no combination of shakes and checks is permitted which would reduce strength to a greater extent than would the allowable size of either separately. Shake in green material is assumed to reduce shearing stress in direct proportion to its extent. A greater amount of shake is permitted in seasoned material, made up for by the increased resistance of the remaining cross section when seasoned.

H17. In joist and plank, and beams and stringers, shake in green material is permitted in direct proportion of increase from none in a grade of the strength of green, clear wood to $\frac{1}{2}$ the width of the piece in a grade having one-half the strength of green, clear wood. In seasoned material, shake is similarly permitted from $\frac{1}{9}$ the width of the piece in a grade of the strength of green, clear wood to $\frac{5}{9}$ the width of the piece in a grade having one-half the strength of green, clear wood.

H18. Shakes and checks, as a rule, have little influence on the strength of columns, unless so extensive as to split a column practically in two. Limitation of shakes and checks in columns is more important from the standpoints of appearance, and of reducing opportunity for decay. In post and timber grades, shake in green material is permitted in direct proportion of increase from $\frac{2}{10}$ the width of the piece in a grade of the strength of green, clear wood to $\frac{6}{10}$ the width of the piece in a grade having one-half the strength of green, clear wood. In seasoned material, shake is similarly permitted from $\frac{3}{10}$ the width of the piece in a grade having the strength of green, clear wood to $\frac{7}{10}$ the width of the piece in a grade having one-half the strength of green, clear wood.

H19. Slope of grain, resulting either from diagonal sawing or from spiral or twisted grain in the log, is limited in accordance with the recommendations of the Forest Products Laboratory, based on the results of detailed study of the effect of cross and spiral grain on strength, and the weakening of material by checks which invariably develop and, without exception, follow the grain.

There is not much reduction in strength from cross grain in a piece of dimension or a beam until an angle of 1 in 40 is reached. From that slope in a beam an angle of grain of 1 in 20 reduces strength about $\frac{1}{4}$; 1 in 15, about $\frac{1}{3}$; 1 in 11, $\frac{2}{3}$; and 1 in 8, $\frac{3}{4}$. In a post for column, an angle of 1 in 15 reduces strength about $\frac{1}{4}$; 1 in 11, about $\frac{1}{3}$; 1 in 8, $\frac{2}{3}$; and 1 in 6, $\frac{3}{4}$.

H20. There is not much reduction in strength from cross grain in a piece of dimension or in a beam until a slope of 1 in 40 is reached. From that slope in a beam of a grade having the strength of green, clear wood, slope of grain is limited to 1 in 20 in a grade having seven-eighths this strength, to 1 in 15 in a grade of three-fourths, 1 in 11 in a grade of five-eighths, and 1 in 8 in a grade of one-half the strength of green, clear wood.

H21. In a post or column the influence on strength of cross grain and of the checks following the grain are much less than in a piece in bending, but excessive cross or spiral grain is objectionable on account of the twisting

and diagonal checks which occur in seasoning. Slope of grain in a post or column is limited to 1 to 20 in a grade having the strength of green, clear wood, 1 in 15 in a grade of seven-eighths this strength, 1 in 11 in a grade of three-fourths, 1 in 8 in a grade of five-eighths, and 1 in 6 in a grade having one-half the strength of green, clear wood.

H22. Slope of grain should be measured over a distance which will assure the determination of the general slope of the grain not influenced by short, local deviations. In a piece in bending, it is of greatest importance on the top and bottom faces. If meeting the limitation of a grade in these locations, it may be greater elsewhere.

H23. Wane is limited by such considerations as bearing area, nailing edge, appearance, etc., rather than by effect on strength. The percentage reduction in strength resulting from wane toward the center of a beam is about double the percentage reduction in cross-sectional area. No combination of wane and knots is permitted which would reduce the strength more than the maximum allowable knot. The occurrence of maximum wane and maximum knot in the same cross section at the center of a beam would be so rare, however, and the effect of the allowable maximum wane is so small a percentage of the effect of the maximum allowable knot, that the additional reduction in strength beyond the effect of the knot would be slight and it is usually unnecessary to give attention to combination of wane and knot.

H24. Pitch pockets are ordinarily not defects in a structural grade. A large number, however, indicates a general lack of bond, and such a piece should be carefully inspected for shakes.

H25. Heartwood and sapwood have been found by the Forest Products Laboratory to be of equal strength, and no requirement of heartwood need be made when strength alone is the governing factor. Heart requirement, when durability of untreated material under exposure is a factor, as in bridges, trestles, docks and piers, or in damp buildings, or buildings in which conditions of high humidity prevail, may be specified in any grade, according to exposure and use.

When preservative treatment is to be applied, there should be no restriction as to sapwood, as sapwood is easier to treat than heartwood and a large amount is to be preferred.

H26. The density of the wood substance of all species is practically the same. The dry weight is, therefore, a measure of the amount of wood substance present; and on the amount of wood substance present depends the strength of the clear wood. No pieces of exceptionally light weight are permitted in the Select grades, but light weight pieces otherwise of Select grade may be accepted in the Common grades.

H27. In southern pine and Douglas fir, the proportion of summerwood, the dark portion of the annual ring, furnishes a practical means of estimating density. Selection of these species for density, to the extent that dense material is commercially available, assures material of the highest character from the standpoint of strength, and uniformity in strength, in the clear wood.

H28. Selection of Douglas fir and southern pine for rate of growth is not as great an assurance of increased strength as selection for percentage of summerwood, but for many purposes selection for rate of growth will assure material of suitable type. Close grain, i. e., not less than six nor more than twenty annual rings per inch, is required in the Select grades of those species.

H29. In acceptance for density the contrast in color between summerwood and springwood should be distinct. Absence of contrast occasionally occurs in bands of growth rings which appear on the whole darker in color than the adjacent material. The summerwood merges into the springwood abnormally



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with a gradual change of color, leaving practically no material which has the normal appearance of springwood. Such material has been called by a number of names, including proud wood, red wood, and compression wood. It has a decided end shrinkage, is weak in tension, and material of this character in even a small part of a cross section is undesirable in high-class structural timbers.

H30. Structural grades specify minimum which may be present at one time. The same defect does not usually affect more than one property, but greater density may compensate, to some extent, for any defect or all defects at once. When a particular piece which is being inspected, therefore, is slightly below the provisions of the grade in some respects but is of average density or above, the relative effect on the properties affected should be given consideration.

H31. In inspection for density, reasonable variation of opinion between inspectors should be recognized. A fair provision for reinspection of a particular lot of timbers for density would be that for every three timbers accepted as having one-third or more summerwood, one of the remaining timbers be accepted if agreed to between 30 and 33 1/3 per cent summerwood.

H32. A large percentage of material in standard yard grades of Dimension and Timbers will meet the additional requirements of structural grades for Joist and Plank, and Posts and Timbers, and material to meet these requirements can easily be selected from local stocks. Beams and Stringers vary materially in size and are not stocked extensively. These are essentially special order grades.

H33. The strength of round timbers of any species may be assumed to be identical with that of square timbers of the same grade and cross-sectional area. Tapered timbers should be assumed as of uniform diameter, the point of measurement being one-third the span from the small end, but the diameter should not be assumed to be more than one and one-half times the end diameter.

H34. The strength of round columns may be considered the same as that of square columns of the same cross-sectional area. In long tapered columns the strength may be assumed as identical with that of a square column of the same length, and of cross-sectional area equal to that of the round timber measured at a point one-third its length from the small end. The stress at the small end must not exceed the allowable stress for short columns.

IV. STRUCTURAL MATERIAL.

Basic Provisions for the Selection and Inspection of Softwood Dimension and Timbers Where Working Stresses Are Required.

The following provisions are for use as a basis for the preparation by lumber manufacturers of grading rules for structural material. It is understood that these basic provisions are not to be used as grading rules, but are merely a standardized working basis to enable manufacturers of the various species to coordinate their grades as far as possible.

1. BASIC GRADE AND USE CLASSIFICATIONS.

66. Basic Grades:

- (a) **Dense Select.**
Douglas Fir and Southern Pine.
- (b) **Select.**
Douglas Fir.
- (c) **Select.**
Other Softwood Species except Southern Pine.
- (d) **Dense Common.**
Douglas Fir and Southern Pine.
- (e) **Common.**
All Softwood Species.

67. Use Classifications:

- (a) **Joist and Plank.**
Joists, Rafters, Plank, Factory Flooring, etc.

(b) Beams and Stringers.

Beams, Girders, Stringers, etc.

(c) Posts and Timbers.

Posts, Caps, Sills, other Timbers, etc.

2. OPTIONAL PROVISIONS.

68. No heartwood requirements are provided in these grades. Heartwood when desired, for durability of untreated timber, should be specified in terms of heartwood required on the girth, or on each face, side, or edge. Girth shall be measured at the point where the greatest amount of sapwood occurs.

69. For material to be treated, a large amount of sapwood is to be preferred. It is not practicable to specify a minimum sapwood requirement, but it could be provided that there is no restriction on sapwood.

70. Wane is permissible in all grades, as far as strength properties are concerned, but square edges may be specified when appearance, bearing, or other factors of use require.

3. GENERAL PROVISIONS.

Sound Wood.

71. All grades shall contain only sound wood, free from any form of decay, incipient or advanced, including firm red heart, dote, and rot.

Definitions of Faces and Edges.

72. The faces of a piece of dimension or of a timber are the four longitudinal surfaces of the piece, sometimes further designated as "wide" faces or "narrow" faces.

73. In a piece of dimension or of a timber graded for use in bending, wide faces shall be taken as vertical faces, and narrow faces as horizontal faces, unless otherwise noted.

74. When the faces of a piece of dimension or of a timber are of equal width, Post and Timber grades shall be used unless otherwise noted. When such a piece of dimension or such a timber is graded for use in bending, the best faces shall be taken as the horizontal faces and should be so marked.

75. The edges of a piece of dimension or of a timber are understood to be the narrower faces, and the sides the wider faces. In describing the locations of knots and other defects in structural material, however, the edges of a given face are understood to be the intersection of two adjacent faces, commonly called corners in the past.

Knots.

76. The size of a knot shall be measured on the section of the knot appearing on the face under consideration.

77. On narrow faces of joist and plank, and on narrow or horizontal faces of beams and stringers, the size of a knot shall be taken as its width between lines parallel to the edges of the piece.

78. On wide or vertical faces of beams and stringers, the smallest diameter of a knot shall be taken as its size.

79. Knots at edges of wide or vertical faces of beams and stringers are limited to the same size as on adjacent narrow or horizontal faces, but the size is measured on the least diameter of the knot instead of on its width between lines parallel to the edges of the piece.

80. In posts and timbers, and on wide faces of joist and plank, the size of a knot shall be measured on the mean or average diameter. The mean or average diameter of a knot shall be taken as the average of the maximum and minimum diameters.

81. The size of knots on narrow faces and at edges of wide faces of joist and plank, and on narrow or horizontal faces and at edges of wide or vertical faces of beams and stringers, may increase proportionately from the size allowed in the middle third to twice that size at the ends of the piece.

82. The size of knots on wide faces of joist and plank, and on wide or vertical faces of beams and stringers, may increase proportionately from the size allowed at the edge to that allowed at the center line.

83. Cluster knots and knots in groups are not permitted.



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84. Knot holes and holes from other causes than knots shall be limited as provided for knots.

Shakes and Checks.

85. Shake shall be measured on the ends of a piece.

86. In joist and plank, and in beams and stringers, the size of a shake shall be taken as the shortest distance between lines enclosing the shake and parallel to the wide faces of the piece.

87. In posts and timbers, the size of a shake shall be measured between lines parallel to each pair of opposite faces, and the greater of these two distances shall be taken as its size.

88. Checks and splits shall be limited as provided for shakes. No checks or combinations of checks with shakes which would reduce the strength to a greater extent than the allowable shake shall be permitted.

Pitch Pockets.

89. Pitch pockets ordinarily are not defects in a structural grade. A large number in a piece, however, indicates a general lack of bond, and such a piece should be carefully examined for shakes.

Slope of Grain.

90. Slope of grain shall be measured over a distance which will assure the determination of the general slope of the grain not influenced by short, local deviations. In a piece in bending, slope of grain is of greatest importance on the top and bottom faces. If meeting the limitation of a grade in these locations, it may be somewhat greater elsewhere.

Wane.

91. Where wane is permitted, there shall be no combination of wane and knots which would reduce the strength more than the maximum allowable knot.

Weight.

92. No pieces of exceptionally light weight shall be permitted in any grade.

Basis of Measurement of Size.

93. The dressed dimensions specified in Paragraphs 114, 122, and 129, shall be minimum dimensions when measured green.

4. DENSITY AND CLOSE GRAIN.

94. Methods of measurement of Douglas Fir and Southern Pine for density are given for use with the dense grades. Methods of measurement for rate of growth shall be given for use in the case of species and grades where close grain is required.

Dense Douglas Fir.

95. Douglas fir of dense material shall average on either one end or the other not less than six annual rings per inch, and, in addition, one-third or more summerwood, the darker, harder portion of the annual ring, measured over a three-inch portion of a radial line located as described below. The contrast in color between summerwood and springwood shall be distinct.

96. Coarse grained material excluded by this rule shall be accepted as dense if averaging one-half or more summerwood.

97. In inspection for density, reasonable variation of opinion between inspectors must be recognized. In reinspection of a particular lot of timbers for density, for every three timbers accepted as having one-third or more summerwood, one of the remaining timbers shall be accepted if agreed upon as having between 30 and 33-1/3% summerwood.

Close Grained Douglas Fir.

98. Douglas fir of close grain shall average on either one end or the other not less than six nor more than twenty annual rings per inch, measured over a three-inch portion of a radial line located as described below.

99. Pieces averaging from five to six annual rings per inch shall be accepted as equivalent of close grain if having one-third or more summerwood.

Location of Radial Line in Douglas Fir.

100. The radial line shall be representative of the average growth on the cross-section.

101. When the radial line specified is not representative, it shall be shifted sufficiently to present a fair average, but the distance

from the pith to the beginning of the three-inch portion of the line in boxed heart pieces shall not be changed.

102. In case of disagreement, two radial lines shall be chosen, and the number of rings per inch or percentage of summerwood shall be taken as the average determined on these lines.

103. In boxed heart pieces, the radial line shall run from the pith to the corner farthest from the pith. When the least dimension is six inches or less, the three-inch portion of the line shall begin at a distance of one inch from the pith. When the least dimension is more than six inches, the three-inch portion of the line shall begin at a distance from the pith equal to two inches less than one-half the least dimension of the piece.

104. In side cut pieces, the radial line shall be at a right angle to the annual rings and the center of the three-inch portion of the line shall be at the center of the end of the piece.

105. If a three-inch portion of a radial line cannot be obtained, the measurement shall be made over as much of a three-inch portion as is available.

Dense Southern Pine.

106. Southern Pine of dense material shall average on either one end or the other not less than six annual rings per inch, and, in addition, one-third or more summerwood, the darker, harder portion of the annual ring, measured over the third, fourth, and fifth inches of a radial line from the pith. The contrast in color between summerwood and springwood shall be sharp and the summerwood shall be dark in color, except in pieces having considerably above the minimum requirement for summerwood.

107. Coarse grained material excluded by this rule shall be accepted as dense if averaging one-half or more summerwood.

108. In inspection for density, reasonable variation of opinion between inspectors must be recognized. In reinspection of a particular lot of timbers for density, for every three timbers accepted as having one-third or more summerwood, one of the remaining timbers shall be accepted if agreed upon as having between 30 and 33-1/3% per cent summerwood.

Location of Radial Line in Southern Pine.

109. The radial line shall be representative of the average growth on the cross section.

110. In case of disagreement, two radial lines shall be chosen, and the number of rings per inch and percentage of summerwood shall be taken as the average determined on these lines.

111. In boxed heart pieces, the measurement shall be made over the third, fourth, and fifth inches from the pith along the radial line.

112. In material containing the pith but not a five-inch radial line, which is less than two inches by eight inches in section or less than eight inches in width, that does not show over sixteen square inches on the cross section, the inspection shall apply to the second inch from the pith. In larger material that does not show a five-inch radial line, the inspection shall apply to the three inches farthest from the pith.

113. In cases where timbers do not contain the pith and it is impossible to locate it with any degree of accuracy, the same inspection shall be made over 3" on an approximate radial line beginning at the edge nearest the pith in timbers over three inches in thickness and on the second inch nearest the pith in timbers three inches or less in thickness.

5. JOIST AND PLANK.

Joists, Rafters, Plank, Factory Flooring, etc.

114. Nominal thicknesses: 2" to 4".

Nominal widths: 4" and wider.

Standard thicknesses, S1S or S2S: 3/8" off.

Standard widths, 4" to 7", S1E or S2E:

3/4" off.

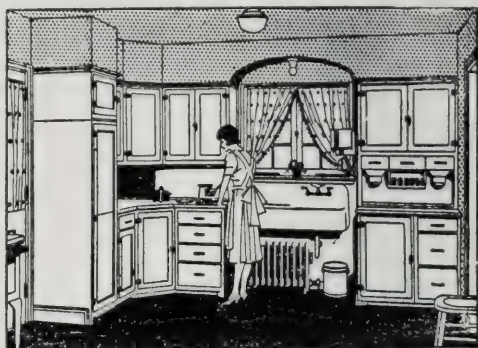
8" and wider, S1E or

S2E: 1/2" off.

Standard lengths: Multiples of two feet.

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115. Knots on Wide Faces

(s) Dense Select and Select		Width of face	(c) Dense Common and Common	
At edge of wide face middle third of length	On center line of wide face		At edge of wide face middle third of length	On center line of wide face
3/4"	1 1/4"	4"	1"	1 3/4"
1"	2"	6"	1 1/2"	2 1/2"
1 3/8"	2 5/8"	8"	2"	3 3/8"
1 3/4"	3 1/4"	10"	2 1/2"	4 1/4"
2 1/8"	4"	12"	3"	5 1/8"
2 3/8"	4 1/4"	14"	3 1/4"	5 5/8"
2 1/2"	4 3/8"	16"	3 3/8"	6"

116. Knots on Narrow Faces of Boxed Heart Pieces, Middle Third of Length

(s) Dense Select and Select	Thickness of piece	(c) Dense Common and Common
5/8"	2"	7/8"
1"	3"	1 1/4"
1 1/4"	4"	1 3/4"

117. Sum of Diameters of Knots on Any Face, Center Half of Length, Not to exceed

(s) Dense Select & Select	(c) Dense Common and Common
1 1/2 times width of face	Two times width of face

118. Shakes and Checks

(s) Dense Select & Select	(c) Dense Common and Common
1/4 width of end Green	4/10 width of end
3/8 width of end Seasoned	4/9 width of end
119. Slope of Grain, Center Half of Length	

(s) Dense Select & Select	(c) Dense Common and Common
1 in 12	1 in 10

120. Wane

(s) Dense Select & Select	(c) Dense Common and Common
1/4 width of any face	1/4 width of any face
121. Douglas fir or southern pine of dense grades shall be selected for density.	
Douglas fir of Select grade shall be selected for close grain.	

6. BEAMS AND STRINGERS. Beams, Girders, Stringers, etc.

122. Nominal thicknesses: 5" and thicker.
Nominal widths: 8" and wider.
Standard lengths: Multiples of two feet.
S1S, S1E, S2S or S4S: 1/2" off each way.
123. Knots.

(s) Dense Select and Select		Width of face	(c) Dense Common and Common	
On narrow or horizontal face middle third of length	On Center line of wide or vertical face		On narrow or horizontal face middle third of length	On Center line of wide or vertical face
1 1/4"	1 1/4"	5"	2"	2"
1 1/2"	1 1/2"	6"	2 3/8"	2 3/8"
1 3/4"	2"	8"	2 3/4"	3 1/8"
2"	2 1/2"	10"	3 1/4"	4"
2 1/8"	3"	12"	3 3/8"	4 3/8"
2 1/4"	3 1/4"	14"	3 5/8"	5 1/8"
2 3/8"	3 3/8"	16"	3 7/8"	5 1/2"
	3 5/8"	18"		5 7/8"
	3 7/8"	20"		6 1/8"
	4"	22"		6 1/2"
	4 1/4"	24"		6 3/4"

INDEX TO REFERENCE CODE TO STRUCTURAL GRADES

	Dense Select Douglas Fir and Southern Pine	Select Douglas Fir and Southern Pine	Select Other Softwoods	Common All Softwoods
Joist and Plank.....	1	2	3	4
Beams and Stringers.....	5	6	7	8
Posts and Timbers.....	9	10	11	12

124. Sum of Diameters of Knots on Any Face, Center Half of Length, Not to Exceed

(s) Dense Select & Select	(c) Dense Common and Common
Width of face	1 1/2 times width of face

125. Shakes and Checks

(s) Dense Select & Select	(c) Dense Common and Common
1/4 width of end Green	4/10 width of end
3/8 width of end Seasoned	4/9 width of end

126. Slope of Grain, Center Half of Length

(s) Dense Select & Select	(c) Dense Common and Common
1 in 15	1 in 10

127. Wane

(s) Dense Select & Select	(c) Dense Common and Common
1/4 width of any face	1/4 width of any face

128. Douglas fir or southern pine of dense grades shall be selected for density.
Douglas fir of Select grade shall be selected for close grain.

7. POSTS AND TIMBERS.

129. Nominal sizes: 6" x 6" and larger.
Standard lengths: Multiples of two feet.
S1S, S1E, S2S or S4S: 1/2" off each way.

130. Knots.

(s) Dense Select and Select	Width of face	(c) Dense Common and Common
1 1/4"	6"	2 3/8"
2"	8"	3 1/8"
2 1/2"	10"	4"
3"	12"	4 3/4"
3 1/4"	14"	5 1/8"
3 3/8"	16"	5 1/2"
3 5/8"	18"	5 7/8"
3 7/8"	20"	6 1/8"
4"	22"	6 1/2"
4 1/4"	24"	6 3/4"

*On faces less than 6 inches in width, knots shall not exceed:
In Dense select and select... 1/4 width of face
In Dense common and common... 4/10 width of face.

131. Sum of Diameters of all Knots Within any 6" of Length, Not to Exceed Dense Select and Select Dense Common and Common

Twice size of maximum knot allowable; nor to be two of maximum allowable knots in same 6 inches of length on any one face.

132. Shakes and Checks.

(s) Dense Select & Select	(c) Dense Common and Common
1/10 width of end... Green	1/2 width of end
1/2 width of end Seasoned	6/10 width of end

133. Slope of Grain.

(s) Dense Select & Select	(c) Dense Common and Common
1 in 10	1 in 8

134. Wane.

(s) Dense Select & Select	(c) Dense Common and Common
1/4 width of any face	1/4 width of any face
135. Douglas fir or southern pine of Dense grades shall be selected for density.	
Douglas fir of Select grade shall be selected for close grain.	

REFERENCE CODE TO STRUCTURAL GRADES

Note—This is not a part of "American Lumber Standards." It is only a suggested adaptation of same which seems to be in accord with common practice.

Numbers refer to Paragraphs of Basic Provision for Structural Material of American Lumber Standards.

1. **Joist and Plank**, Dense Select, Douglas Fir and Southern Pine. 61(a), 62(a), 63, 64, 65, 66, 69, 70, 71, 72, 73, 74, 75, 80, 81, 82, 83, 84(s), 85(s), 86(s), 87(s), 88(s), 89(s).

2. **Joist and Plank**, Select, Douglas Fir and Southern Pine. 61(b), 62(a), 63, 64, 65, 66, 69, 70, 71, 72, 73, 74, 75, 79, 80, 81, 83, 84(s), 85(s), 86(s), 87(s), 88(s), 89(s).

3. **Joist and Plank**, Select, Other Softwood Species. 61(b), 62(a), 63, 64, 65, 66, 69, 70, 71, 72, 73, 74, 75, 83, 84(s), 85(s), 86(s), 87(s), 88(s), 89(s).

4. **Joist and Plank**, Common, All Softwood Species. 61(c), 62(a), 63, 64, 65, 66, 69, 70, 71, 72, 73, 74, 75, 83, 84(c), 85(c), 86(c), 87(c), 88(c), 89(c).

5. **Beams and Stringers**, Dense Select, Douglas Fir and Southern Pine. 61(a), 62(b), 63, 64, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 80, 81, 82, 91, 92(s), 93(s), 94(s), 95(s), 96(s).

6. **Beams and Stringers**, Select, Douglas Fir and Southern Pine. 61(b), 62(b), 63, 64, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 79, 80, 81, 91, 92(s), 93(s), 94(s), 95(s), 96(s).

7. **Beams and Stringers**, Select, Other Softwood Species. 61(b), 62(b), 63, 64, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 91, 92(s), 93(s), 94(s), 95(s), 96(s).

8. **Beams and Stringers**, Common, All Softwood Species. 61(c), 62(b), 63, 64, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 91, 92(c), 93(c), 94(c), 95(c), 96(c).

9. **Posts and Timbers**, Dense Select, Douglas Fir and Southern Pine. 61(a), 62(c), 63, 64, 65, 71, 72, 73, 74, 75, 80, 81, 82, 98, 99(s), 100, 101(s), 102(s), 103(s).

10. **Posts and Timbers**, Select, Douglas Fir and Southern Pine. 61(b), 62(c), 63, 64, 65, 71, 72, 73, 74, 75, 79, 80, 81, 98, 99(s), 100, 101(s), 102(s), 103(s).

11. **Posts and Timbers**, Select, Other Softwood Species. 61(b), 62(c), 63, 64, 65, 71, 72, 73, 74, 75, 98, 99(s), 100, 101(s), 102(s), 103(s).

12. **Posts and Timbers**, Common, All Softwood Species. 61(c), 62(c), 63, 64, 65, 71, 72, 73, 74, 75, 98, 99(c), 100, 101(c), 102(c), 103(c).

(s) Grade Provision for Dense Select and Select Grade.

(c) Grade Provision for Common Grade.

No heartwood requirements are provided in these grades. Heartwood requirements when ordered should be specified in terms of heartwood required on the girth, or on each face side or edge. Girth shall be measured at the point where the greatest amount of sapwood occurs. (See par. 76.)

Wane is permitted in all grades, but square edges may be specified when appearance or use requires. (See par. 78.)

Douglas Fir and Southern Pine of select grade are required to be of close grain.

Douglas Fir and Southern Pine of dense select grade are required to be of dense material.

COMMON USE OF AMERICAN LUMBER STANDARD GRADES IN GENERAL BUILDING CONSTRUCTION.

Frame Construction.	
Item	Grade—American Lumber Standards
Sills and Plates.....	No. 1 Common Dimension
Posts.....	Common Posts and Timbers
Girders.....	Select or Common Beams and Stringers
Studs.....	No. 1 or 2 Common Dimension
Joist.....	Common Joist and Plank
Rafters.....	Common Joist and Plank
Bridging and Furring.....	No. 2 Common Strips
Under-Flooring.....	No. 1 or 2 Common Boards
Sheathing.....	No. 1 or 2 Common Boards
Roof Boarding.....	No. 1 or 2 Common Strips or Boards
Shingles: Roofs.....	A
Walls.....	B
Finished Flooring.....	B Flooring
Porch Flooring.....	B Flooring, Vertical Grain
Stepping.....	B Stepping, Vertical Grain
Siding.....	B or C Siding
Ceiling.....	B or C Ceiling
Partition.....	B or C Partition
Finish and Trim:	
Interior.....	B for Natural Finish C for Paint Finish B or C Finish
Exterior.....	B or C Finish
Window Frames:	
Exposed Portions.....	B Select
Covered Portions.....	No. 1 Common or Better
Timber Construction.	
Item	Grade—American Lumber Standards
Caps and Sills.....	Select Posts and Timbers
Posts.....	Select or Dense Select Posts and Timbers
Knee Braces.....	Select Posts and Timbers
Sway Braces.....	Select or Common Joist and Plank
Girders.....	Select or Dense Select Beams and Stringers
Beams.....	Select or Dense Select Beams and Stringers
Joist.....	Select or Common Joist and Plank
Planking: Flat.....	Select or Common Joist and Plank
Laminated.....	Select or Common Joist and Plank
Platform.....	Select Joist and Plank, Vertical Grain
Stepping.....	B or C Stepping, Vertical Grain
Truss Members:	
Tension.....	Select Beams and Stringers
Compression.....	Select Posts and Timbers
Diagonal.....	Select Posts and Timbers
Finished Flooring.....	B Flooring, Vertical Grain
Ceiling.....	B or C Ceiling
Partitions: Plank.....	No. 1 Common Dimension
Finished.....	B or C Partition
Finish: Interior.....	B for Natural Finish C for Paint Finish B or C Finish
Exterior.....	B or C Finish
Window Frames:	
Exposed Portions.....	B Select
Covered Portions.....	No. 1 Common or Better

Notes on the Use of Recommended Grades.

1. Grades recommended are the grades most commonly used. For temporary construction, a grade lower may often be used. For work of the highest character, a grade higher may be desired.
2. Where alternate grades are given, the choice in structural grades would depend on the working stress used; in other grades it would depend on the grades or character of material available in a particular locality.
3. Wane is permitted in structural grades. Square edges may be specified when required for bearing or desired for appearance.
4. Heartwood and sapwood of equivalent character are of equal strength. No requirement of heartwood need be made when strength alone is the governing factor.
5. Heart requirement, when durability of untreated wood, subject to exposure, is a factor, may be specified in any grade. Heartwood requirement should be in terms of the percentage of heartwood required on the girth, or on each face, side or edge.
6. A loose knot or knot hole does not reduce strength any more than a tight knot,

so no distinction is made in structural grades between knots and knot holes. Where appearance is a factor, tight knotted stock should be specified.

7. The provisions of the Joist and Plank grades are such that working stresses for these grades may be applied to material used with wide faces vertical or horizontal.

8. Joist or Beam grades may be used for pieces in direct tension, such as bottom chords of trusses, increase in size of dets. toward ends being permissible because of the gradual application of stresses through splice plates or end connections. The same stresses may be used in direct tension as for extreme fiber stress in bending.

9. Loads concentrated near a support give a calculated shearing stress higher than is actually developed. In calculating the shear at one end of a beam the concentrated loads between that end and a point distant three times the depth of the beam from the support may be considered as acting at this point.

10. Shear stresses for joint details may be taken as 50 per cent greater than the values for horizontal shear given in the table

DESCRIPTION OF SOUTHERN PINE ASSOCIATION STANDARD SPECIFICATION FOR THE SELECTION AND INSPECTION OF DENSE LONGLEAF AND SHORTLEAF SOUTHERN YELLOW PINE.

STRUCTURAL GRADES.

The Structural Grading Rules of Southern Yellow Pine furnish material suitable for all construction uses. All structural material is classified by grades in which defects are limited and which require certain qualities in the clear wood. Consideration has been given to factors which reduce the strength and to factors that clearly indicate strength above the average.

Four grades of Southern Yellow Pine timbers are furnished, each of which is especially suitable for certain classes of work. The four grades are: Select Structural, Dense Heart, Structural Square Edge and Sound, and Number One Common.

All of the timber grades Except No. 1 Common, have a density requirement. Select Structural and Dense Heart have heartwood requirements.

SELECT STRUCTURAL TIMBERS.

Select Structural grade requires all material to conform to the density requirement and to show 85 per cent heartwood, girth measurement. This grade is obtainable only on special orders. It is for use where exceptional conditions require unusually high unit strength values, such as in extra long bridge spans or under heavily loaded floors in mill construction where clear floor space with a limited number of columns is required.

DENSE HEART.

Dense Heart Grades require all material to conform to the Density requirement and to show some heart the entire length on one side on pieces under 9 inches, and some heart the entire length on two opposite faces on pieces 9 inches and over. Dense Heart is the grade expected to furnish most of the timbers used in heavy construction work where high breaking strength is desired. This grade can be cut in sufficient quantities to supply all the heavy construction timbers which the trade will use.

STRUCTURAL SQUARE EDGE AND SOUND.

Structural Square Edge and Sound requires all material to conform to the density requirement. Unless otherwise specified, this grade admits any amount of sapwood. This grade is for general use in building construction and to a large extent in mill construction. It is especially adapted to treatment with chemical preservatives.

SOUTHERN PINE FACTORY FLOORING AND ROOFING PLANK.

SELECT MERCHANTABLE.

This grade is for use where durability and strength are required. It must be free from wane and must show two-thirds heart sur-

NO. 1 COMMON TIMBERS.

No. 1 Common grade is intended for general use and in small houses, false work, and ordinary construction where strength requirements are not so critical. This grade is also suitable where stiffness is the controlling factor. As the stiffness of the low grades is only slightly less than that of the higher grades, the consumer can obtain a material in this grade suitable for his purpose at a low cost.

UTILITY TIMBERS.

Timbers that are intended for remanufacture or for industrial uses are grouped under UTILITY TIMBERS. The grades of UTILITY TIMBERS are, Merchantable, Square Edge and Sound and No. 1 Common. Density is not required in these grades unless otherwise specified.

MERCHANTABLE TIMBERS.

Merchantable Timbers may be specified Dense; shall show two-thirds or more heart surface on one of the wide faces on sizes under 9 inches, and two-thirds or more heart surface on both of the wide faces on pieces 9 inches and over. This grade is well manufactured and is suitable for uses in which the application of working stresses is not necessary, and for remanufacture into material where durability is important.

SQUARE EDGE AND SOUND.

Square Edge and Sound timbers may be specified Dense. Unless otherwise specified, this grade will admit any amount of sapwood. This grade is well manufactured and is suitable for remanufacture into material that may easily be treated with a chemical preservative. This grade is well suited for uses where working stresses are not applied and conditions surrounding its use do not require unusual durability.

NO. 1 COMMON.

No. 1 Common Timbers are classed under Utility Timbers, although this grade is especially adapted to small building construction. Unless otherwise specified, this grade will admit any amount of sapwood.

HEART TIMBERS.

All timber specifications except Merchantable, Dense Heart, and Select Structural Timbers specifying heart requirements, shall be considered as a special contract, and shall specify whether the heart requirements refer to surface or girth measurements in each piece.

face the entire length of the piece on one side, and show some heart two-thirds the length on the opposite side. This grade will admit sound knots, the average diameter of

any one knot not to exceed approximately one-fourth the cross section of the piece in the rough, if located at the edge, or one-third the cross section if located away from the edge. Other defects also limited.

STANDARD.

This grade is for use where strength is required without reference to durability. It must be free from wane. This grade will admit sound knots, the average diameter of

any one knot not to exceed approximately one-fourth the cross section of the piece in the rough, if located at the edge, or one-third the cross section if located away from the edge. Other defects also limited.

GRADING RULES.

Detailed specifications for these grades are given in "Standard Specifications For Grades of Dense Longleaf and Shortleaf Southern Yellow Pine", issued by the Southern Pine Association, New Orleans, La.

DESCRIPTION OF WEST COAST LUMBERMEN'S ASSOCIATION STANDARD STRUCTURAL GRADES FOR DOUGLAS FIR

Structural Grades

The Structural grades of the West Coast Lumbermen's Association conform to the Grades and Uses of the Basic Provisions for Structural Material of American Lumber Standards, for the selection and inspection of softwood dimension and timbers where working stresses are required, and in addition provide a Super-Structural grade in each of the three Use classifications for use when material of exceptionally high character is required.

Grades and Use Classifications

Grades: (a) Super-Structural

(b) Structural

(c) Common Structural

Uses:

(a) Joist and Plank

Joists, Rafters, Scaffold Plank, Factory, Flooring, etc.

(b) Beams and Stringers

Beams, Girders, Stringers, etc.

(c) Posts and Timbers.

Posts, Caps, Sills, Timbers, etc.

Material for each of the three Use classifications can be obtained in each of the three Grade classifications, and in addition, dense material may be specified in each of the three Grade classifications, making eighteen Grade-Use combinations to provide suitable material for every possible structural requirement.

The Structural grades are equivalent to the Select Structural grades of the Basic Provisions. The Common Structural grades are equivalent to, or better than, the Common Structural grades of the Basic Provisions. The Super-Structural grades provide material of higher quality than the Select Structural grades of the Basic Provisions.

The majority of requirements in Joist and Plank will be met by the Common Structural grade, as in proper design of material for these purposes stiffness is usually the governing factor and exceptionally high bending strength can not be utilized.

In Beams and Stringers, high bending strength is usually desired, and in this use the Structural grade will usually be desired, with Super-Structural grade where exceptionally heavy loads are to be carried, or minimum possible sizes are desired.

In Posts and Timbers, the Common Structural grade will usually provide material of ample size for the loads to be carried, but the Structural grade will more often be desirable, because of the requirement of close grain and the minimum checking which this provides in square timbers of considerable size.

In truss members, maximum strength or minimum size are often required, and Super-Structural grades may often be desired for this use.

The Super-Structural and Dense Structural grades are equal in strength, hence give interchangeability in material of close grain and small defects, or dense material with larger defects.

Standard Grades

Standard Grading and Dressing Rules West Coast Lumbermen's Association, Seattle, Washington, dated July 1, 1929.

209. Super Structural Posts and Timbers.

Must be sound, square-edged, well manufactured and close grained as defined in Para-

graph 301; free from spiral or diagonal grain with a slope of more than 1" in a length of 20". Will admit occasional slight variation in sawing and any number of the following defects or their equivalent:

Knots—sound tight, if not in clusters, approximately:

$\frac{3}{4}$ " on a 6" face.

1" on an 8" face.

$1\frac{1}{4}$ " on a 10" face.

$1\frac{1}{2}$ " on a 12" face.

$1\frac{3}{4}$ " on a 14" face.

2" on 16" and wider faces.

Checks—seasoning.

Pitch Pockets—not over 6" in length.

Sap— $\frac{3}{4}$ width, $\frac{1}{8}$ thickness.

210. Structural Posts and Timbers.—Must be sound, square-edged, well manufactured and close grained as defined in Paragraph 301; free from spiral or diagonal grain with a slope of more than 1" in a length of 15". Will admit occasional slight variation in sawing, and any number of the following defects or their equivalent:

Knots—sound tight, if not in clusters, approximately:

$1\frac{1}{4}$ " on a 6" face.

$1\frac{1}{2}$ " on an 8" face.

2" on a 10" face.

$2\frac{1}{2}$ " on 12" and wider faces.

In timbers having faces 24" or wider or lengths 50' and longer the size of knots may be proportionately larger in relation to their effect on the strength of the piece.

Checks—seasoning.

Pitch Pockets—medium.

Sap— $\frac{1}{4}$ thickness, $\frac{1}{8}$ width.

211. Common Structural Posts and Timbers.—Must be sound, well manufactured, free from spiral or diagonal grain with a slope of more than 1" in a length of 10". Will admit occasional slight variation in sawing and any number of the following defects or their equivalent:

Knots—sound tight, if not in clusters, approximately:

$1\frac{1}{2}$ " on a 6" face.

2" on an 8" face.

$2\frac{1}{2}$ " on a 10" face.

3" on a 12" face.

$3\frac{1}{2}$ " on 14" and wider faces.

Spike Knots.

Pitch Pockets.

Pitch Streaks.

Checks—seasoning.

Sap Stain—medium, 25% of any face.

Wane—2" wide on one corner or equivalent based on 10"x10".

213. Super Structural Joists, Etc.—Must be sound, square-edged, well manufactured and close grained as defined in Paragraph 301; free from spiral or diagonal grain with a slope of more than 1" in a length of 20". Will admit occasional slight variation in sawing and any number of the following defects, or their equivalent:

Knots—sound tight, if not in clusters, approximately:

$\frac{1}{2}$ " on a 4" face.

$\frac{3}{4}$ " on a 6" face.

1" on an 8" face.

$1\frac{1}{4}$ " on a 10" face.

$1\frac{1}{2}$ " on a 12" face.

$1\frac{3}{4}$ " on a 14" face.

2" on 16" and wider faces.

Checks—seasoning.

Pitch Pockets—not over 6" in length.

Torn Grain.

214. Structural Joists, Etc.—Must be sound, square-edged, well manufactured and close grained as defined in Paragraph 301; free from spiral or diagonal grain with a slope of more than 1" in a length of 15". Will admit occasional slight variation in sawing and any number of the following defects or their equivalent:

Knots—sound tight, if not in clusters, approximately:

$\frac{1}{2}$ " on 2" to 3" faces.
$\frac{3}{4}$ " on a 4" face.
1" on a 6" face.
$1\frac{1}{2}$ " on an 8" face.
$1\frac{3}{4}$ " on a 10" face.
2" on a 12" face.
$2\frac{1}{4}$ " on 14" and wider faces.

Checks—seasoning.

Pitch Pockets—medium.

Torn Grain.

Skips—small, not opposite each other.

215. Common Structural Joists, Etc.—Must be sound, well manufactured, free from spiral or diagonal grain with a slope of more than 1" in a length of 10". Will admit occasional slight variation in sawing and any number of the following defects or their equivalent:

Knots—sound tight, if not in clusters, approximately:

$\frac{3}{4}$ " on 2" to 3" faces.
1" on a 4" face.
$1\frac{1}{2}$ " on a 6" face.
2" on an 8" face.
$2\frac{1}{2}$ " on a 10" face.
3" on a 12" face.
$3\frac{1}{4}$ " on 14" and wider faces.

Spike Knots—which do not weaken piece more than knots heretofore specified.

Pitch Pockets.

Pitch Streak.

Wane— $\frac{1}{4}$ thickness, $\frac{1}{4}$ width, $\frac{1}{3}$ length of piece.

Split—short, equal in length to width of piece.

Sap Stain—medium.

Checks—seasoning.

Torn Grain.

217. Super Structural Stringers, Etc.—Must be sound, square-edged, well manufactured and close grained as specified in Paragraph 301; free from spiral or diagonal grain with a slope of more than 1" in a length of 20" in the center three-fourths of the length of the piece. Will admit occasional slight variation in sawing, and any number of the following defects or their equivalent:

Knots—sound tight, if not in clusters, approximately:

Width Inches	Size of Knot On Narrow Faces Inches	Size of Knot on Center Line of Wide Face Inches
5	$\frac{1}{2}$	...
6	$\frac{3}{4}$	...
8	1	1
10	1	$1\frac{1}{4}$
12	$1\frac{1}{4}$ Maximum	$1\frac{1}{2}$
14	...	$1\frac{3}{4}$
16	...	2 Maximum

The diameter of a knot on the narrow face shall be measured between lines parallel to the edges of the narrow face. On the wide face the knot shall be measured on the smallest diameter. Knots at the edges of a wide face are limited to the same size as on the adjacent narrow face, but measured on the smallest diameter, and the sizes may increase proportionately to the size allowed at the center line of the wide face.

Checks—seasoning.

Pitch Pockets—medium.

Sap—1" on narrow face 2" on wide face measured over its widest point.

218. Structural Stringers, Etc.—Must be sound square-edged, well manufactured and close grained as defined in Par. 301; free from spiral or diagonal grain with a slope

of more than 1" in a length of 15" in the center three-fourths of the length of the piece. Will admit occasional slight variation in sawing, and any number of the following defects, or their equivalent:

Knots—sound tight, if not in clusters, approximately:

Width of Face Inches	Size of Knot On Narrow Faces Inches	Size of Knot on Center Line of Wide Face Inches
5	1	...
6	$1\frac{1}{4}$	...
8	$1\frac{1}{2}$	$1\frac{3}{4}$
10	$1\frac{3}{4}$	$2\frac{1}{4}$
12	$1\frac{3}{4}$	$2\frac{1}{2}$
14 & wider	2 Maximum	3 Maximum

The diameter of a knot on the narrow face shall be measured between lines parallel to the edges of the narrow face. On the wide face the knot shall be measured on the smallest diameter. Knots at the edges of a wide face are limited to the same size as on the adjacent narrow face, but measured on the smallest diameter, and the sizes may increase proportionately to the size allowed at the center line of the wide face.

Pitch Pockets—medium.

Checks—seasoning.

Sap—2" on edges and 3" on faces, measured over its widest point.

219. Walking Beams.—This item shall be graded by the same rule as Par. 218, except that sap shall not be limited.

220. Common Structural Stringers, Etc.—Must be sound, well manufactured, free from spiral or diagonal grain with a slope of more than 1" in a length of 12" in the center $\frac{1}{2}$ of the length of the piece. Will admit occasional slight variation in sawing and any number of the following defects or their equivalent:

Knots—sound tight, if not in clusters, approximately:

Width of Face Inches	Size of Knot On Narrow Faces Inches	Size of Knot on Center Line of Wide Face Inches
5	$1\frac{1}{2}$	...
6	$1\frac{3}{4}$	...
8	2	$2\frac{1}{2}$
10	$2\frac{1}{4}$	3
12	$2\frac{1}{2}$	$3\frac{1}{2}$
14	$2\frac{3}{4}$	$3\frac{3}{4}$
16	3 Max.	4 Max.

The diameter of a knot on the narrow face shall be measured between lines parallel to the edges of the narrow face. On the wide face the knot shall be measured on the smallest diameter. Knots at the edges of a wide face are limited to the same size as on the adjacent narrow face, but measured on the smallest diameter, and the sizes may increase proportionately to the size allowed at the center line of the wide face.

Checks—seasoning.

Pitch Pockets.

Pitch Streaks.

Sap—medium stain 25% of face.

Wane— $1\frac{1}{2}$ " wide on one corner or equivalent based on 10" face.

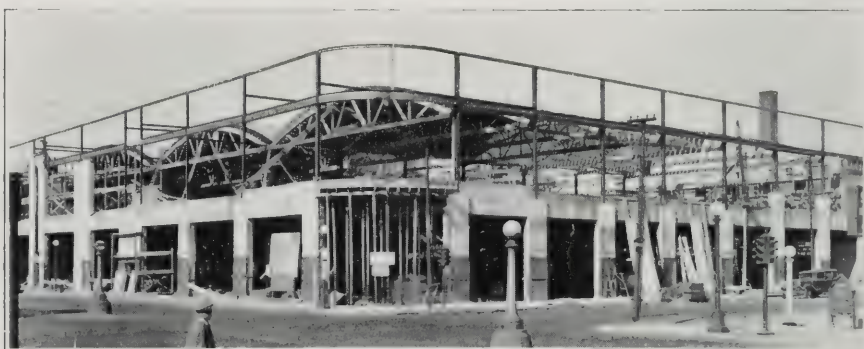
302. Dense material shall average on either one end or the other of a piece not less than six annual rings per inch and, in addition, one-third or more summerwood (the dark portion of the annual ring), measured over the same portion of a radial line as provided for close grain. The contrast in color between summerwood and springwood shall be distinct.

Coarse grained material excluded by this rule shall be accepted as dense if averaging one-half or more summerwood.

In case of disagreement, two radial lines shall be chosen and the summerwood and number of rings shall be taken as the average on these lines.



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AMERICAN STANDARD LUMBER

MARCH, 1928

CHICAGO RETAIL LUMBER DEALERS ASSOCIATION

TABLE OF STRENGTH YELLOW PINE & DOUGLAS FIR BEAMS CHICAGO BUILDING ORDINANCE (1910)

FIBRE STRESS 1300 LBS. IN²

SHEAR 130 LBS. IN²

LOAD IN POUNDS (UNIFORMLY DISTRIBUTED)

BASED ON ACTUAL DRESSED SIZES

Weight of Beam Included

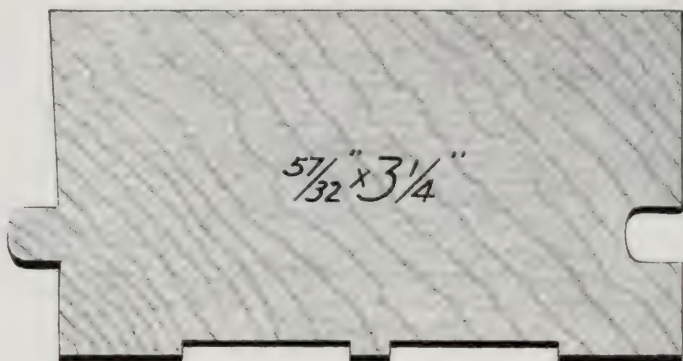
STRENGTH
Unplastered Construction
Width in Inches

DEFLECTION LIMITED
Plastered Construction
Width in Inches

2 in.	3 in.	4 in.	6 in.	8 in.	10 in.	12 in.	Span in Feet	2 in.	3 in.	4 in.	6 in.	8 in.	10 in.	12 in.
6 in. Beam = 5½ in. Load in Pounds Except 6 x 6 = 5½ x 5½ in.								6 in. Beam = 5½ in. Load in pounds. Except 6 x 6 = 5½ x 5½ in.						
1485	2398	3314	4806	.....	.....	.....	5	1485	2398	3314	4806	.....	.....	.....
1237	1999	2761	4005	.....	.....	.....	6	1237	1999	2761	3922	.....	.....	.....
1061	1713	2367	3428	.....	.....	.....	7	910	1471	2031	2881	.....	.....	.....
928	1499	2071	3004	.....	.....	.....	8	697	1126	1555	2206	.....	.....	.....
825	1332	1841	2670	.....	.....	.....	9	551	890	1229	1743	.....	.....	.....
742	1199	1657	2403	.....	.....	.....	10	446	720	995	1412	.....	.....	.....
675	1030	1506	2184	.....	.....	.....	11	368	595	822	1167	.....	.....	.....
618	999	1380	2002	.....	.....	.....	12	309	500	691	980	.....	.....	.....
8 in. Beam = 7½ in.								8 in. Beam = 7½ in.						
1885	3046	4207	6383	8705	.....	.....	7	1885	3046	4207	6383	8705	.....	.....
1649	2666	3681	5585	7616	.....	.....	8	1649	2666	3681	5585	7616	.....	.....
1466	2369	3272	4965	6770	.....	.....	9	1306	2109	2913	4420	6028	.....	.....
1319	2132	2944	4468	6093	.....	.....	10	1057	1708	2360	3580	4882	.....	.....
1199	1938	2677	4062	5539	.....	.....	11	874	1412	1950	2959	4035	.....	.....
1099	1777	2454	3723	5077	.....	.....	12	734	1186	1638	2486	3390	.....	.....
1015	1640	2265	3437	4687	.....	.....	13	626	1011	1396	2118	2889	.....	.....
942	1523	2103	3191	4352	.....	.....	14	539	871	1204	1826	2491	.....	.....
879	1421	1963	2979	4062	.....	.....	15	470	759	1048	1591	2170	.....	.....
824	1333	1840	2792	3808	.....	.....	16	413	667	921	1398	1907	.....	.....
10 in. Beam = 9½ in.								10 in. Beam = 9½ in.						
2647	4277	5907	8962	12221	15479	.....	8	2647	4277	5907	8962	12221	15479	.....
2353	3801	5251	7966	10863	13759	.....	9	2353	3801	5251	7966	10863	13759	.....
2118	3421	4725	7169	9776	12383	.....	10	2118	3421	4725	7169	9776	12383	.....
1925	3110	4296	6518	8888	11258	.....	11	1776	2870	3963	6014	8201	10388	.....
1765	2851	3938	5974	8147	10319	.....	12	1493	2411	3330	5053	6891	8728	.....
1629	2632	3635	5515	7520	9526	.....	13	1272	2035	2838	4305	5871	7437	.....
1512	2444	3375	5121	6983	8845	.....	14	1096	1772	2447	3712	5062	6413	.....
1412	2281	3150	4779	6517	8255	.....	15	955	1543	2131	3234	4410	5586	.....
1323	2138	2953	4481	6110	7739	.....	16	839	1356	1873	2842	3876	4909	.....
1245	2012	2779	4217	5771	7284	.....	17	743	1201	1659	2518	3433	4349	.....
1176	1900	2625	3983	5431	6879	.....	18	663	1071	1480	2246	3062	3879	.....
1114	1800	2487	3773	5157	6517	19	595	962	1328	2015	2748	3481
1059	1710	2362	3584	4888	6191	20	537	868	1199	1819	2480	3142

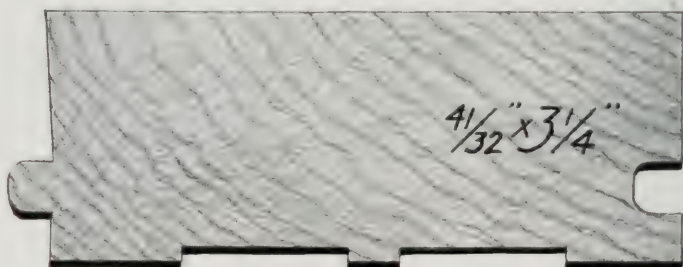
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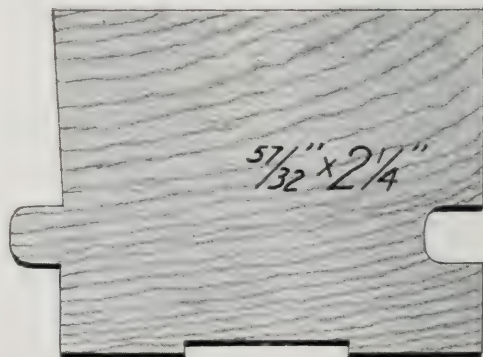
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2 in.	3 in.	4 in.	6 in.	8 in.	10 in.	12 in.	Span in Feet	2 in.	3 in.	4 in.	6 in.	8 in.	10 in.	12 in.
12 in. Beam = 11½ in.								12 in. Beam = 11½ in.						
3239	5232	7225	11212	14950	18936	22923	9	3239	5232	7225	11212	14950	18936	22923
3017	5014	6924	10506	14326	18147	21968	10	3017	5014	6924	10506	14326	18147	21968
2743	4558	6295	9551	13024	16497	19971	11	2743	4558	6295	9551	13024	16497	19971
2514	4178	5770	8755	11939	15122	18306	12	2514	4178	5770	8755	11939	15122	18306
2321	3857	5326	8082	11020	13959	16898	13	2256	3645	5034	7638	10415	13193	15970
2155	3581	4946	7504	10239	12962	15691	14	1945	3143	4340	6586	8980	11375	13770
2011	3343	4616	7004	9551	12098	14645	15	1695	2738	3781	5737	7823	9909	11995
1886	3134	4327	6566	8954	11341	13730	16	1489	2406	3323	5042	6876	8709	10543
1775	2949	4073	6180	8427	10674	12922	17	1319	2131	2943	4466	6090	7715	9339
1676	2785	3847	5837	7959	10081	12204	18	1177	1901	2625	3980	5432	6881	8330
1588	2639	3644	5529	7540	9551	11562	19	1056	1706	2356	3575	4876	6176	7476
1508	2507	3462	5253	7163	9073	10984	20	953	1540	2126	3227	4400	5574	6747
1437	2387	3297	5003	6822	8641	10461	21	864	1397	1929	2927	3991	5055	6120
1371	2279	3147	4775	6512	8248	9985	22	788	1272	1757	2667	3636	4606	5576
1312	2180	3010	4568	6229	7890	9551	23	720	1164	1608	2440	3327	4214	5102
1257	2089	2885	4377	5969	7561	9153	24	662	1069	1477	2241	3056	3870	4685
14 in. Beam = 13½ in.								14 in. Beam = 13½ in.						
3402	6142	8482	13162	17550	22230	26910	11	3802	6142	8482	13162	17550	22230	26910
3564	5758	7952	12068	16452	20840	25227	12	3564	5758	7952	12068	16452	20840	25227
3290	5315	7340	11140	15187	19237	23287	13	3290	5315	7340	11140	15187	19237	23287
3055	4935	6816	10344	14102	17863	21623	14	3055	4935	6816	10344	14102	17863	21623
2851	4606	6361	9654	13162	16672	20182	15	2742	4429	6117	9281	12656	16031	19406
2673	4318	5964	9051	12339	15630	18920	16	2410	3893	5376	8157	11123	14089	17056
2516	4064	5613	8518	11613	14710	17807	17	2134	3448	4762	7225	9853	12481	15108
2376	3838	5301	8045	10968	13893	16818	18	1904	3076	4248	6445	8789	11132	13476
2251	3636	5022	7622	10391	13162	15933	19	1709	2760	3812	5784	7888	9991	12095
2138	3454	4771	7241	9871	12504	15136	20	1542	2491	3440	5220	7119	9017	10916
2037	3290	4544	6896	9401	11908	14415	21	1399	2260	3121	4735	6457	8179	9901
1944	3140	4337	6582	8974	11367	13760	22	1274	2059	2843	4314	5883	7452	9021
1859	3004	4149	6296	8584	10873	13162	23	1166	1884	2601	3947	5383	6818	8254
1782	2879	3976	6034	8226	10420	12613	24	1071	1730	2389	3625	4943	6262	7580
16 in. Beam = 15½ in.								16 in. Beam = 15½ in.						
4338	7007	9676	14682	20020	25359	30698	13	4338	7007	9676	14682	20020	25359	30698
4028	6506	8985	13633	18590	23547	28505	14	4028	6506	8985	13633	18590	23547	28505
3759	6073	8386	12724	17351	21978	26605	15	3759	6073	8386	12724	17351	21978	26605
3524	5693	7862	11929	16266	20604	24942	16	3524	5693	7862	11929	16266	20604	24942
3317	5358	7399	11227	15309	19392	23475	17	3231	5219	7208	10936	14913	18890	22887
3133	5060	6988	10603	14459	18315	22171	18	2882	4655	6429	9755	13302	16849	20397
2968	4794	6620	10045	13698	17351	21004	19	2586	4178	5770	8755	11939	15122	18306
2819	4554	6289	9543	13013	16483	19954	20	2334	3771	5207	7901	10775	13468	16521
2685	4337	5990	9088	12393	15698	19003	21	2117	3420	4723	7167	9773	12379	14985
2563	4140	5718	8675	11830	14985	18140	22	1929	3116	4304	6530	8905	11279	13654
2451	3960	5469	8298	11316	14333	17351	23	1765	2851	3937	5974	8147	10320	12492
2349	3795	5241	7952	10844	13736	16628	24	1621	2618	3616	5487	7482	9478	11473
2255	3643	5031	7634	10410	13186	15963	25	1494	2413	3333	5057	6896	8735	10573
2169	3503	4838	7341	10010	12679	15349	26	1381	2231	3081	4675	6375	8076	9776
18 in. Beam = 17½ in.								18 in. Beam = 17½ in.						
4792	7741	10690	16219	22117	27981	33914	15	4792	7741	10690	16219	22172	27981	33914
4492	7257	10022	15206	20735	26232	31794	16	4492	7257	10022	15206	20735	26232	31794
4228	6830	9432	14311	19515	24689	29924	17	4228	6830	9432	14311	19515	24689	29924
3993	6450	8908	13516	18431	23317	28262	18	3993	6450	8908	13516	18431	23317	28262
3783	6111	8439	12805	17461	22090	26774	19	3722	6013	8305	12600	17182	21764	26346
3594	5805	8017	12164	16588	20985	25435	20	3359	5427	7495	11372	15507	19642	23778
3422	5529	7636	11585	15798	19986	24224	21	3047	4922	6798	10314	14065	17816	21567
3267	5278	7289	11059	15080	19078	23123	22	2776	4485	6194	9398	12816	16233	19651
3125	5048	6972	10578	14424	18248	22118	23	2540	4104	5667	8598	11725	14852	17979
2995	4838	6681	10137	13823	17488	21196	24	2333	3769	5205	7897	10769	13640	16512
2875	4644	6414	9731	13270	16788	20348	25	2150	3473	4796	7278	9924	12571	15217
2764	4466	6167	9357	12760	16143	19566	26	1988	3211	4435	6729	9176	11622	14069

THE KELLOGG-MACKAY COMPANY

Heating and Plumbing Supplies

General Offices and Warehouses

1351 West 37th Place

CHICAGO

A COMPLETE SERVICE FOR THE HEATING AND PLUMBING CONTRACTOR

ARCHITECTS and ENGINEERS are vitally interested in Service and Performance on any large operation.

During the past thirty-five years the KELLOGG-MACKAY COMPANY has developed this service to a high degree of efficiency.

For the Heating and Plumbing Contractor we can furnish the entire requirements for the largest installation and can co-ordinate the various items so that all materials will be delivered at the proper time.

The lines which we handle have been proven the best over a great many years and are nationally advertised and universally accepted as representing the highest grade in their respective divisions.

The Kellogg-Mackay Company

BRANCHES:

Minneapolis
St. Paul

Chicago
Kansas City

Hutchinson
Dodge City

SOME OF THE NEWER INSTRUMENTS OF SERVICE IN HEATING AND VENTILATING

By **SAMUEL R. LEWIS, Mechanical Engineer**

Heaters and Combustion Appliances.

Most cast iron boilers now are provided with built-on steel jackets outside of the insulation. This protects the insulation and is far superior to the old canvas and wire.

Automatic water line governors or automatic feeders in case of low water in steam or vapor boilers used in heating, are exceedingly desirable as a safety device when gas or oil is used as the fuel and when city water of higher pressure than the pressure carried on the heating system is available.

Many of the modern boilers adapted to burning oil have extra compartments fitted with grates and ashpits in which garbage and rubbish may be burned without interfering with the oil combustion. This extra compartment may be a great advantage if the owner has forgotten to order oil, or if there is any interruption of the supply of electric energy.

Boilers of this type may be used to burn wood or other solid fuel normally, while if the attendant allows the manually-tended fire to die down and if heat is needed, the oil burner will come into play automatically.

With the varying and often very low gas pressures now encountered in the Public Service Company's mains it sometimes is difficult to secure uniform and efficient combustion if we must use the power derived from the gas pressure, as in injectors, to draw in and to mix air with the gas so as to form a combustible mixture. We have learned to use controlled power, as exemplified in electric energy, for making a combustible gas by admixture of oil and air. There is good reason to apprehend that we should do the same thing when we burn gas, and there are now available mechanically-driven gas-air mixers and burner appliances which are measurably independent of the Public Service Company's gas pressure and which can be regulated with much greater precision than can the older gravity gas mixers.

Heating directly with electric energy is expensive and has not in most localities proved economically practicable, except for emergency and short time application. Off-peak electric heating by storing hot water, as during the night, against the daytime demand of the building, has not proved sufficiently interesting to justify very much rate-reduction for such electric heating by the Public Service Companies. One major reason for this is that while stored water heated during off-peak hours would smooth things out for that particular day, it would not give work for the generating station during any of the days when warm weather was in effect. Some hope is held out that low electric rates may be feasible and profitable for heating domestic hot water. The demands for hot water for cooking and cleansing are exceedingly uni-

form throughout the year. This water usually is stored for some hours in tanks against the time of greatest demand. Electricity could be used to heat this domestic hot water, and the central station peaks could be ironed out beneficially by use.

Automatic stokers, when we must burn solid fuel, even though we burn anthracite coal, are on the market. Some of these devices even remove the ashes automatically, and many types are available for the smaller sized heating plants such as we use in residences.

Chicago apartment houses which do not have the steady supply of heat and the absence of smoke which are due to automatic stokers, are as unpopular as the apartment houses which still use ice boxes.

Controllers for Heat.

When the windows go down in the Fall each year, the people begin to have colds, and certain diseases which follow colds begin to appear in the Health Department records. Over-heating and then the drafts which come from throwing up the windows are believed to be more responsible for colds than any particular poison in the air itself.

It usually is easier to open the window than to close off the radiator valve, and results in terminating the over-heating are obtained much more quickly. However there is a very definite waste of heat if the radiator valve is allowed to be open too long, especially if one opens the window to compensate.

Savings in fuel due to automatic shutting down of the heat production are so great in many cases, especially in residential quarters, as to seem fabulous to the uninitiated. We all know that we cannot reasonably afford to burn gas or oil if we fail to limit the combustion of these fuels, as with thermostats. There are several well established concerns which can furnish complete automatic temperature control, not only of the oil or gas or coal combustion rate, but also control of the dampers and the valves; using compressed air or low voltage electricity. There are others, and the number grows, which furnish radiator valves which have built-in thermostats and these valves may easily be adjusted to close themselves off when the room space around them becomes warmer than the point at which the thermostats are set.

Such simple devices as these self-contained valves appeal because they should endure for many years without adjustment or repairs, and while they may not hold the room temperature to an unvarying line, without slight fluctuations, they do not cost very much, and they do limit over-heating and may bring about great fuel savings.

Anyhow, who desires an even temperature?

KEWANEE

Specialists in Steel Firebox Boilers,
Brick-Set and Portable; Up-Draft
and Down-Draft Smokeless, Type
C and Type R Welded. Built much stronger than A. S. M. E. Code
requires.

BOILERS

Brick-Set Up-Draft Fire-Box

This has been the Standard Boiler for general use in the Central West for many years, and is the Boiler referred to in specifications as "Kewanee or equal."

Number of Boiler	0	1	2	3	4	5	6	8	9	10	11	12	13	14	15	16	17	18	19	20
Capacity, Steam..... sq. ft.	510	690	940	1250	1380	1830	2410	3340	4170	4300	5130	6070	7440	8770	10320	12080	12470	11670	16410	18600
Capacity, Water..... sq. ft.	820	1110	1510	2000	2210	2930	3850	5350	6700	7000	8200	9700	12000	14000	16500	19440	20000	23500	26100	29000
Diameter of Boiler..... in.	24	30	30	30	35	36	36	42	42	48	48	48	54	54	60	60	66	66	72	72
Diameter of Stack..... in.	10	12	12	14	14	16	16	18	20	20	22	22	26	26	30	30	30	30	34	34
Minimum Height of Stack..... ft.	35	40	40	40	40	40	45	45	45	45	50	50	50	50	55	55	60	60	60	60

Portable Up-Draft Fire-Box

Requires less floor space and more height than above. No special skill in brick laying.

Number of Boiler	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424
Capacity, Steam..... sq. ft.	2550	3340	4170	4300	5130	6070	7440	8770	8700	10320	12470	14560	16350	18240	21200	23950	30920	33980
Capacity, Water..... sq. ft.	4100	5350	6700	6900	8200	9700	12000	14100	14000	16500	20000	23300	24200	29200	34000	34000	45000	54500
Diameter of Boiler..... in.	48	48	48	54	54	54	60	60	60	60	66	66	72	72	78	78	84	84
Diameter of Stack..... in.	20	20	20	22	22	22	24	24	26	26	28	30	32	32	34	34	38	40
Minimum Height of Stack..... ft.	50	50	55	55	55	60	60	60	65	65	65	70	70	70	80	90	90	100

Portable Smokeless Down-Draft Fire-Box

A Smokeless Boiler designed to burn cheap soft coal. Breaching connection at front, economical of space.

Number of Boiler	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324
Capacity, Steam..... sq. ft.	3390	4260	5010	6100	6950	7650	8290	9010	10100	10820	12770	14740	16860	18120	20410	21690	29050	36810
Capacity, Water..... sq. ft.	5120	6820	8020	9800	11200	12300	13300	14500	16200	17400	20500	23600	27000	29500	32800	34750	46500	59000
Diameter of Boiler..... in.	48	48	48	54	54	54	60	60	60	60	66	66	72	72	78	78	82	84
Diameter of Stack..... in.	20	20	20	22	22	22	23	23	26	26	28	30	32	32	34	34	38	40
Minimum Height of Stack..... ft.	50	55	55	55	55	55	70	70	70	65	65	65	70	70	80	90	90	100

Type C Smokeless and Straight Draft

Compact shape Boiler for restricted accommodations.

Number of Boiler	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770
Capacity, Steam, . sq. ft.	2300	2690	3250	3630	4060	4550	5250	5950	6470	7000	8280	9610	10850	12110	14300	16380	18660	20750	22520	25530	28780	33070
Width of Boiler, . in.	36	36	36	36	42	42	42	48	48	48	54	54	60	60	66	66	72	72	78	78	84	84
Length of Boiler, . in.	50	56	68	76	70	78	90	73	79	85	89	103	96	107	115	130	118	131	130	146	131	149
Diameter, Stack, . in.	18	20	20	20	22	22	22	24	24	26	26	28	30	30	32	32	34	34	38	38	40	40
Minimum Height Stack ft.	45	50	50	55	55	55	60	60	60	65	65	65	70	70	70	80	80	90	90	100	100	100

Rated Capacity for Water Boiler is 60% Greater than Capacity of Steam Boiler.

Portable Type K Firebox Boiler for Smaller Buildings

No. 0K to 20K Up-draft, capacity 510 to 15800 sq. ft.

No. 104K to 112K Down-draft, capacity 1640 to 5950 sq. ft.

Type "R" Residence Boiler

No. 740 to 748 for Soft Coal, 370 to 1,960 Sq. Ft. Capacity

No. 1740 to 1748 for Oil, 450 to 2,380 Sq. Ft. Capacity

No. 2740 to 2748 for Hard Coal 430 to 1,960 Sq. Ft. Capacity

Separate Catalogs on Oil Burning Firebox Boilers—Power Boilers—Slim Type Radiation—
Steel Storage Tanks—Garbage Burners—Tabasco Hot Water Heaters

KEWANEE BOILER CORPORATION

Kewanee, Ill., Chicago, Ill., 1858 S. Western Ave., Phone Roosevelt 5800
Branches in principal cities of the United States

Reasonable fluctuations in temperature are stimulating and desirable.

Electric energy through thermostats and other appliances will do almost anything desired in the way of heat control. It will cause injection into the combustion chamber of the fuel, coal—gas—oil, or what have you, and will stop it when enough has been injected. It will, if you wish, not stop this injection when the central thermostat in your living room gets warm, unless a second thermostat placed against the pipe which heats your remote and unusually exposed bedroom also has become warm. If the electric or gas ignition device for your oil or your gas burner fails, a thermostat will cause the apparatus to cease injecting fuel and so will forefend any chance of an explosion. If your stoker fire goes out, a thermostat equally well will prevent the stoker from jamming coal into the furnace. If the combustion chamber or the breeching get too hot, evidence of something wrong somewhere, a thermostat will stop proceedings and will give notice thereof.

If your central oil burning heater supplies heat to several departments or zones in your premises, you may control each zone with a thermostat which will operate a valve in the branch main which serves that zone. When all zones are warm and only then does the combustion of fuel cease; yet the demand of any of the zones will cause the burner to start again.

An ingenious gadget recently evolved in connection with electric automatic heat control is a window switch. This is a tiny enclosed switch attached to the window, say of any apartment or hotel. The window may be opened a trifle—depending on adjustment of the switch, to give a breath of air, but if you open the window any great amount you will cause the heat supply to that room to be shut off, resulting of course in great fuel savings, and in increase of comfort, since the room will cool off more quickly when its supply of heat is closed, thus satisfying your presumed demand when you opened the window.

We also have a hook-up, accomplished electrically, between two thermostats, one inside and one outside, which works so that the heat production by the heating system automatically is proportioned inversely to the temperature changes outside.

There are available, also, dual systems of heat control, which will maintain somewhat cooler conditions at night, for instance, than those required during the hours of occupancy, the throw-over from one temperature to the other being a very simple switch-operation.

When we connect up a clock with a thermostat, thus bringing in the time element, we can make the output of the heater responsive to the sun or to our daily activities, and there are many controlled heating plants which can operate year in and year out, without the slightest human attention.

Unit Heating Machines.

The outstanding revolution in heat transmitting equipment of recent years, has to do with electric fans in connection with steam or water or gas-heated surfaces. These devices are called unit heaters or unit heating machines.

If given enough fan power and if of special design to suit, these machines may maintain comfort in the occupancy-zones of lofty rooms or buildings and may maintain very much lower temperatures at the ceilings or roofs and in the high parts of the room, than is necessary when we use ordinary stoves or radiators. At first these unit heating machines were crude, unsightly, noisy and would blow out chilly drafts whenever the supply of heat failed, and would give a blast of heat until they had to be shut off in self defense; then a long cold spell would ensue.

Nowadays these machines are vastly improved. If the supply of heat fails, the fan stops automatically; thus not committing drafts. Instead of the hot blast when no hot blast is needed we may have a slowly varying gentle breeze, due to the influence of a thermostatically operated mixing damper built into the machine.

These unit heating machines when they use electricity for heating as well as for power, are exceedingly flexible and capable, and are economically justifiable in mild climates, and in any climate where a little quick heat may be wanted to boost up the bath room for the baby's morning bath, or during the between-season times when operation of the main heating system is not quite justified.

Unit heating machines burning gas directly, with electric fans to drive the air over the hot surfaces, are practicable and are in being, and we may predict very great economies and benefits from their use, especially when natural gas again becomes available in Chicago.

With these devices buildings without basements or boiler rooms may be heated comfortably and economically—though we hope that if such buildings shall be built, the owners will refrain from placing the floors directly on the ground.

Building Insulation.

Use of an ample thickness of an enduring and water-proof heat insulator imperatively is demanded in the floors of buildings used for human occupancy if these floors are placed directly on the ground.

Unit Cooling Machines.

Unit heating machines are supplied with something to heat their transmitting surfaces. If these surfaces could be made cool, unit heaters would become very effective coolers, and the troubles due to frosting up of low-temperature refrigeration coils left to absorb heat in still air would be ameliorated. Very successful results may be expected from unit cooling machines when their surfaces are supplied with cool water or with other

Cut-away view of Morse-Boulger Destructor. Specially designed for every building and in any capacity from 62 lbs. per hour to 120 tons of garbage per day.



Provide for Garbage and Waste Material

NOW any building—from the bungalow to the palatial sky-towering hotel—can banish old fashioned methods of garbage and waste disposal by means of the Kernerator or Morse-Boulger Destructor. The cost is small; the gains large.

The Kernerator *should* be in the plans as only rarely can it be installed in an existing building. It consists of a basement combustion chamber built into the regular chimney, with hopper doors on floors above. Into these is dropped all waste—not only garbage, but papers, sweepings, tin cans, etc. The accumulation is air-dried by reason of the patented Kernerator By-Pass and occasional lighting reduces everything to ashes except metallic objects which are flame sterilized. **No fuel required.** Sizes to meet any condition. Built and guaranteed by the pioneers and inventors of flue-fed incineration.

The Morse-Boulger Destructor is most economically installed and most conveniently located when it is drawn into the plans, but can generally be built into existing buildings. Because it embodies the results of over 30 years' experience, exclusive three-way passage of hot gases and separate fuel grate, the M-B Destructor leadership is pronounced among hotels, apartment hotels, hospitals and public and private institutions. Only part of one man's time required to operate it. Uses coal, gas, oil or wood. The modern apartment hotel uses the Kernerator for apartment waste disposal and the M-B Destructor for destruction of all garbage and waste from main and private dining rooms.

For details see Sweet's, write or phone us for literature.

KERNER INCINERATOR CO.

MORSE-BOULGER DESTROYER CO.

HUGH W. EWING, Branch Manager
43 E. Ohio St., Chicago, Ill.

Showing the Kernerator hopper door, flue and basement combustion chamber.

Residence models as low as \$95, and the masonry adds but little more when a regular chimney is used.

HEAVY DUTY INCINERATION
MORSE-BOULGER
DESTRUCTORS

KERNERATOR
THE CHIMNEY-FLUE INCINERATOR

heat-absorbing media. If the cooling surfaces bring the air below the dewpoint, so that moisture collects on the cooling surfaces, drip pans must be provided. The most remote edges only, of the enormous possibilities to be expected from unit cooling machines, have been touched.

Air Drying.

We approach an era in which artificial cooling of spaces intended for human occupancy will be well-nigh as universal as is the artificial heating of such spaces.

In all artificial cooling of air the problem is complicated by the fact that when we reduce the temperature we reduce the volume of air, and this contracted volume of air soon reaches the point where it cannot longer carry the original burden of moisture which in its warmer state it supported with ease.

We have thus the phenomenon of the dew.

All cooling systems have to get rid of this surplus moisture, and in conventional plants we cool the air below the dew point temperature and provide a cool surface on which the dew can be laid down; then warm the air to a comfortable temperature without giving it time to re-evaporate the laid-down dew. All this is an expensive and rather complicated process.

A recent scheme, especially interesting for smaller and gas heated houses, for drying and cooling the air involves contacting the air with a moisture-hungry substance; then baking the moisture out of the moisture-hungry substance by heat. There is a cycle of alternate absorption and evaporation, and effective drying and cooling of the air is accomplished in an efficient manner.

Electro Plated Radiators.

Radiators or heat transferring surfaces of high duty type, such as are used for cooling the water of automobiles or for heating the air delivered by unit heating machines are being made successfully by an unique process. A core is cast out of metal having a low temperature melting point. This core may then be electroplated with copper or some other suitable metal having a comparatively high melting point. Then the low temperature metal is removed by heating the plated device to a point well above the critical temperature of the core, while still not approaching the melting point of the plating. The result is a uniform seamless and very strong heat transfer surface or radiator.

Welding.

Welding of ferrous piping using electricity or oxygen and acetylene is making great strides. The possibilities apparently are limited only by the skill of the workman. The fittings often are all cut and fabricated right on the job when welding is used.

Even though we might not be sure of permanent and tight and safe joints, (and we need have no fears about the joints being permanent and tight and safe,) the use and speed of fabricating of supports, anchors, etc. gained by welding, would justify such an outfit on every sizable job of heating or plumbing. When welding is used there are no exposed, partly cut, surfaces, such as occur with screwed piping. There are far fewer burrs or contractions which reduce the interior cross section than with screwed fittings.

Non-Ferrous Piping.

Copper tubing, made seamless, and hard drawn, so that it is straight and rigid and thin, is making great strides wherever durability and beauty and space-economy are of interest.

Vent piping on plumbing systems and return piping on steam heating systems are points where corrosion-resistance particularly are desirable. Copper tubing with smooth recessed bronze fittings, in many instances will not cost more than ferrous piping with screwed or welded fittings, and probably will outlast the building, with an ultimate salvage value for re-melting equal probably to 40 per cent of its first cost.

It is now possible for the first time, to furnish hard copper tubing in rectangular, triangular or polygonal cross sections with fittings. This piping has ease of working and tightness comparable with results achieved with circular piping. It may be that no great demand exists or will exist for odd shaped pipes, but whenever such need arises the industry is prepared to meet it.

Hot Water Heating.

Hot water heating, due especially to its very low maintenance cost and to its great flexibility, is undergoing something of a renaissance. If well designed, hot water heating need cost very little more than vapor heating. It has few parts to get out of order. It is well adapted to iron out the peaks and valleys due to quick-acting fuels such as oil and gas. The oil burner especially, for a hot water heating system, must not be too large; but should be small enough so that it shall operate almost all of the time in cold weather.

Hot water heating for automobiles in its recent well-advertised phases, awakens consciousness of the flexibility and desirability of this ancient heat carrier. We are all of us heated by hot water to which has been added some red coloring matter, some salts and other constituents of no importance so far as the heat carrying qualities of the blood are concerned.

With modern automatic electric water circulation boosters we can heat rooms whole stories below the hot water boiler, and may place the radiators at the floor, and need have no fears as to satisfactory results.

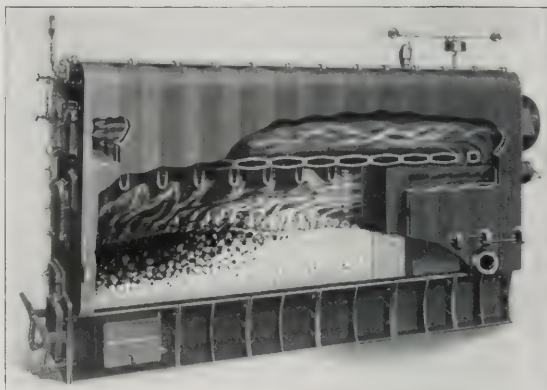
When we encounter service hot water systems which are sluggish we may use these low cost circulation-hurrying devices with great satisfaction, and may control them with thermostats which tip little glass bottles partly full of mercury and which serve as make and break contact switches in the electric power circuits which actuate the motive power for the booster pumps.

Humidity Introduction.

We may now provide any reasonably desired relative humidity in any heated space, using other modern unit machines. Little sprays, worked by water pressure or by mechanical atomizers, or little lakes of water in recesses formed in heated radiators may be used, as the location, or the desire of the user, may dictate. These devices are adopted for automatic humidity control, and usually have arrangements whereby any lack of water or any overflow of water are guarded against.

They may be concealed behind wall grilles, cleverly blended with mirrors, or may look like radio cabinets, or may be built into registers in the floor which seem to be conventional parts of an indirect heating system.

Smokeless



Weil-McLain **SCIENTIFIC COMBUSTION** **BOILERS**

With Longer Smokeless Firing Periods

HERE is a smokeless boiler that possesses unusual utility and structural advantages.

—a boiler that offers longer smokeless firing periods.

—a boiler that is simple and easy to operate.

—a boiler that successfully burns other fuels as readily as soft coal;

—a boiler whose smokeless structure is easily removable for conversion to oil or stoker firing.

In this boiler Grate Vairea,* the principal cause for frequent firing, has been eliminated. Grate Vairea, a condition found oftener

in the ordinary smokeless boiler, causes fuel on one part of an area of grate to burn faster than upon another part.

The thick uniform bed of fuel in the Weil-McLain Smokeless Boiler burns evenly at all points. One firing lasts a longer period of time. One result is that the services of competent janitors or firemen are more easily retained and the problem of constantly hiring and training new men is practically eliminated.

Illustrated catalog giving full details concerning the Weil-McLain Smokeless, Long - Firing-Period Boiler sent on request.

WEIL-McLAIN COMPANY

General Offices
Chicago, Illinois

Boiler Factory
Michigan City, Indiana

Radiator Factory
Erie, Pennsylvania

*Our booklet on Grate Vairea—what it is and how it affects boiler firing periods and efficiency—will be gladly mailed on request.

CHICAGO MASTER STEAM FITTERS' ASSOCIATION

STANDARDS

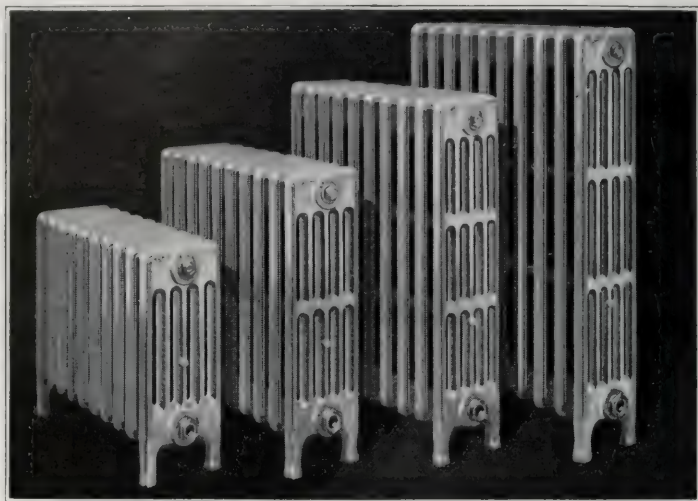
For Computing Boiler Sizes and Radiation Quantities for Buildings of Average Construction.

RULE FOR COMPUTING RADIATOR QUANTITIES FOR HEATING PLANTS.

The following are rules compiled and recommended by the Chicago Master Steam Fitters' Association. However, they should not control against the best judgment of the competent designing engineer.

Factors for Multiplying Square Feet of Surface or Lineal Feet of Crack, to Figure Square Feet of Cast Iron Steam Radiation Required for Heating to 70°.

	Glass	Infiltration	Outside Walls	Roofs	Ceilings	Basement Floors	Interm. Floors	Cold Partitions
Glass—								
Single .....	.293							
Double or Storm .....	.147							
Sky-Light .....	.346							
Infiltration, Stationary—								
Sash .....	.293	.12						
Double Hung Wood or Steel Sash .....	.293	.24						
Casement-Winds .....	.293	.48						
Outside or French Doors .....	.293	.48						
Transoms .....	.293	.48						
Outside Door With Inner Vest. Door .....	.293	.48						
Store Doors .....	.293	.96						
Outside Walls—								
8" Plain Brick .....			.111					
12" Plain Brick .....			.085					
16" Plain Brick .....			.069					
8" Brick and Plaster .....			.10					
12" Brick and Plaster .....			.077					
16" Brick and Plaster .....			.067					
8" Brick Fur Lath and Plaster .....			.072					
12" Brick Fur Lath and Plaster .....			.062					
16" Brick Fur Lath and Plaster .....			.056					
4" Brick, 4" Tile and Plaster .....			.08					
8" Brick, 4" Tile and Plaster .....			.069					
12" Brick, 4" Tile and Plaster .....			.059					
8" Plain Concrete .....			.16					
12" Plain Concrete .....			.14					
16" Plain Concrete .....			.109					
8" Concrete Fur Lath and Plaster .....			.133					
12" Concrete Fur Lath and Plaster .....			.107					
16" Concrete Fur Lath and Plaster .....			.091					
Frame Studding .....			.064					
Frame No Sheathing .....			.082					
Frame On Lath and Plaster .....			.093					
Roofs—								
Tar and Gravel on 1" Boards .....				.08				
Tar and Gravel on 4" Concrete .....				.16				
Shingle on Sheathing .....				.106				
Shingle Sheathing, Lath and Plaster .....				.08				
Basement Floors—								
Concrete on Earth .....						.041		
Wood on Sleepers .....						.017		
Intermediate Floors—								
4" Concrete .....							.026	
4" Concrete, 3" Fill, 1" Fin. ....							.02	
Double Wood .....							.026	
Ceilings—								
Lath and Plaster .....					.065			
Lath and Plaster Wood Floor Over .....					.037			
Cold Partitions Stud. L. and P. 1 Side .....								.08
Cold Partitions Stud. L. & P. 2 Sides .....								.044



Setting new standards of beauty and efficiency in radiation

JUST as Crane plumbing materials have created new ideas in plumbing, these new Crane radiators are destined to create new standards in heating.

In building them, Crane designers and Crane engineers have again co-operated . . . sought to make an object pleasing to the eye as well as efficient in performance. The result is apparent at a glance. Slenderly graceful,

these radiators harmonize with any interior; at the same time they are unsurpassed in heating efficiency. They are made in all sizes, widths, heights, and lengths . . . assembled by a screwed nipple construction which permits easy addition or subtraction of sections. They can be had with or without the Crane Invisible Shield to protect walls and draperies. Full information can be had by writing Crane Co.

Valves



CRANE



Fittings

CRANE CO., GENERAL OFFICES: 836 S. MICHIGAN AVE., CHICAGO
NEW YORK OFFICES: 23 W. 44TH STREET

Branches and Sales Offices in One Hundred and Ninety-six Cities

**FULL AREA OF TWO-PANE WINDOWS
GIVING THE TOTAL AREA OF TWO-PANE WINDOWS, BRICK OPENING.**

Height of Glass Width of Glass	16"	18"	20"	22"	24"	26"	28"	30"	32"	34"	36"	38"	40"
	TOTAL AREA IN SQUARE FEET												
12"	5.9	6.4	7.	7.5	8.	8.6	9.2	9.8	10.2	10.9	11.4	12.	12.5
14"	6.5	7.1	7.7	8.3	9.	9.6	10.2	10.8	11.4	12.	12.6	13.2	13.8
16"	7.	7.7	.4	9.1	9.8	10.5	11.2	11.9	12.6	13.3	14.	14.4	15.
18"	7.6	8.4	9.1	9.8	10.5	11.2	12.	12.7	13.	14.1	14.8	15.6	16.3
20"	8.2	9.	9.8	10.5	11.3	12.1	12.9	13.7	14.5	15.2	16.	16.8	17.5
22"	8.8	9.6	10.4	11.2	12.1	13.	13.8	14.6	15.4	16.2	17.	17.8	18.8
24"	9.4	10.3	11.1	12.	12.9	13.8	14.7	15.6	16.5	17.4	18.3	19.2	20.
26"	10.	10.9	11.8	12.7	13.7	14.7	15.6	16.6	17.5	18.5	19.4	20.4	21.3
27½"	10.4	11.4	12.5	13.4	14.3	15.3	16.3	17.3	18.3	19.3	20.3	21.3	22.2
28"	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	19.5	20.5	21.5	22.5
30"	11.1	12.2	13.2	14.3	15.4	16.4	17.5	18.5	19.6	20.6	21.7	22.7	23.8
32"	11.7	12.8	13.9	15.	16.1	17.2	18.4	19.5	20.9	21.7	22.8	23.9	25.
34"	12.3	13.5	14.6	15.8	17.	18.1	19.3	20.5	21.6	22.9	24.	25.2	26.3
36"	12.9	14.1	15.3	16.5	17.8	19.	20.9	21.4	22.7	23.9	25.1	26.3	27.5
38"	13.5	14.7	16.	17.3	18.6	19.9	21.1	22.4	23.7	25.	26.2	27.5	28.9
40"	14.	15.4	16.7	18.	19.4	20.7	21.6	23.4	24.7	26.	27.4	28.7	30.
44"	15.2	16.7	18.1	19.5	21.	22.4	23.9	25.3	26.8	28.2	29.7	31.1	32.5
48"	16.4	17.9	19.5	21.	22.6	24.2	25.7	27.3	28.8	30.4	31.9	33.5	35.

Sizes not shown, figure brick opening.

**SIZES OF LOW PRESSURE STEAM MAINS
ONE PIPE CIRCUIT SYSTEM
DRIPPED AT END**

1" up to 60 sq. ft.	
1¼" 60 sq. ft. to	100 sq. ft.
1½" 100 sq. ft. to	200 sq. ft.
2" 200 sq. ft. to	400 sq. ft.
2½" 400 sq. ft. to	600 sq. ft.
3" 600 sq. ft. to	900 sq. ft.
3½" 900 sq. ft. to	1,400 sq. ft.
4" 1,400 sq. ft. to	2,000 sq. ft.
4½" 2,000 sq. ft. to	2,600 sq. ft.
5" 2,600 sq. ft. to	3,300 sq. ft.
6" 3,300 sq. ft. to	4,500 sq. ft.
7" 4,500 sq. ft. to	7,000 sq. ft.
8" 7,000 sq. ft. to	9,000 sq. ft.
9" 9,000 sq. ft. to	11,000 sq. ft.
10" 11,000 sq. ft. to	15,000 sq. ft.
12" 15,000 sq. ft. to	24,000 sq. ft.

On all piping, proper provision shall be made for expansion and contraction.

All piping shall be properly pitched.

Supply mains shall not be reduced more than one size larger than one-half the diameter of the largest main.

Dry returns shall be not less than one-half the diameter of the supply.

Wet returns may be one size smaller than one-half the diameter of the supply pipe. By supply pipe is meant the size of main at the point of leaving boiler.

All horizontal branches more than 16 feet in length shall be properly dripped.

Supply mains shall not be reduced more than one-half the diameter of the largest main.

Dry returns shall be not less than one-half the diameter of the supply.

Wet returns may be one size smaller than one-half the diameter of the supply pipe. By supply pipe is meant the size of the main at the point of leaving boiler.

PIPE SIZES FOR UP-FEED RISERS

1"	30 square feet or under.
1¼"	30 to 60 square feet
1½"	60 to 100 square feet
2"	100 to 200 square feet
2½"	200 to 350 square feet
3"	350 to 900 square feet
3½"	900 to 1,200 square feet
4"	1,200 to 2,000 square feet

RADIATOR CONNECTIONS

Up to and including 30 square feet.....1"

Above 30 and including 60 square feet.1¼"

Above 60 and including 100 square feet.1½"

Above 100 square feet.....2"

**PIPE SIZES FOR ARMS TO RADIATORS
AND BRANCHES TO UPFEED RISERS**

1" up to and including	20 square feet.
1¼"— 21 and including	40 square feet.
1½"— 41 and including	80 square feet.
2"— 81 and including	150 square feet.
2½"— 151 and including	275 square feet.
3"— 276 and including	625 square feet.
3½"— 626 and including	1,050 square feet.
4"— 1,051 and including	1,600 square feet.

All horizontal branches or arms more than 8 feet in length and not over 12 feet in length shall be increased one size larger than given above.

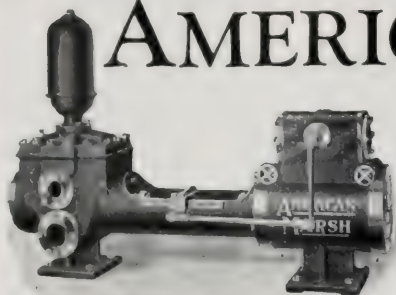
All horizontal branches or arms more than 12 feet in length and not over 16 feet in length shall be increased two sizes larger than given above.

A New Factor in Building Valuations

It is felt that there is need for a new viewpoint in building valuation. In the past it would seem that too much stress has been placed on age and immediate revenue in building valuation. It would seem that the architect, owing to his peculiar training, is in a position to point out other very important factors entering into value make-up, which have not heretofore been considered in this locality; such as, balance of structural design, adaptability to purposes intended, character of construction as influencing cost of up-keep.

Feeling that the stability of building investment can be better assured by taking the before mentioned factors into consideration, the Illinois Society of Architects has appointed a Building Valuation Committee to furnish the public with competent architectural valuation service. This Committee should form a real asset to the community.

AMERICAN-MARSH



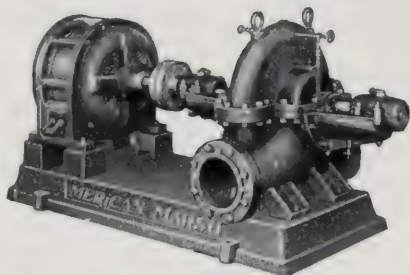
Steam and Power
Pumps

Centrifugal
Pumps

Air Compressors

Condensation
Heating Pumps

Vacuum
Heating Pumps



American Steam Pump Company

J. M. STANNARD, Mgr.

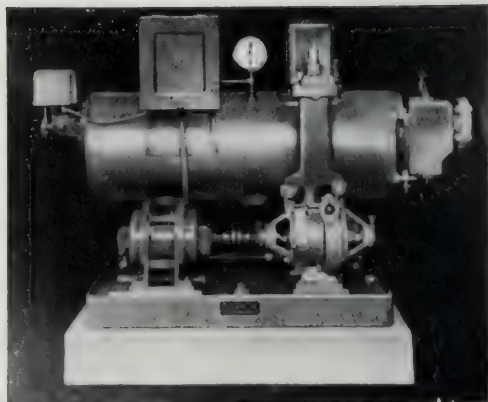
923-928 MONADNOCK BLOCK Telephone: Harrison 1501 CHICAGO, ILL.



The Jennings-Nash Vacuum Heating Pump

THESE are complete vacuum and low pressure boiler feed pumping units. They are compact, silent, and operate on little power. Units are long-lived, as there are no contacting points inside the pump casting.

Thousands of the largest and best office buildings, hotels, institutions, schools and manufacturing plants are fitted up with the Jennings-Nash Heating Units.



STANNARD POWER EQUIPMENT CO.

923-928 MONADNOCK BLOCK Telephone: Harrison 1501 CHICAGO, ILL.

Use the Best and Avoid Trouble

RULES FOR COMPUTING NET BOILER LOADS FOR EQUIVALENT DIRECT CAST IRON COLUMN RADIATION

Copyright 1928, by Heating and Piping Contractors' National Association.

Direct Cast Iron Radiation

It is assumed that Direct Cast Iron Column Radiation will emit 225 B. T. U. per hour per square foot of surface for steam, and 150 B. T. U. per hour per square foot of surface for water, therefore all radiation must be reduced to this heat emission basis.

Rule for Computing Net Boiler Loads for Other Than Cast Iron Column Radiation

Reduce to equivalent cast iron column radiation by adding 25% to pipe coils or cast iron wall radiators on side walls and direct-indirect radiation, and 50% to indirect radiation without fan.

Rule for Computing Net Boiler Loads for Lower Inside Temperatures Than 70° F.

If building is to be heated to less than 70° multiply the equivalent net C. I. column radiation load by the following factors for proper net boiler load:

	Steam	Water
70°	1.	1.
65°	1.03	1.03
60°	1.07	1.07
55°	1.10	1.10
50°	1.13	1.13
45°	1.17	1.17
40°	1.20	1.20

Rule for Computing Boiler Size for Hot Blast Coils

For computing boiler size to be used for Hot Blast Coils use manufacturers' condensation chart and figure .375 lb. of condensation per hour as equivalent to one square foot of direct column radiation.

Rules for Computing Boiler Size for Unit Heaters

For boiler size to be used on unit heater for recirculating air, base unit heater on amount of equivalent direct radiation required.

Rule for Computing Boiler Size for Heating Water for Domestic Use

When water for domestic use is heated by heating boiler, by means of coil in firebox or steam coil in storage tank, size of boiler should be increased, figuring each gallon of water tank capacity as equivalent to two square feet of steam radiation or three square feet of hot water radiation.

For example, a 160-gallon tank should be figured as equivalent to 320 square feet of steam radiation or 480 square feet of hot water radiation.

When water for domestic use is heated by submerged heater with storage tank figure each gallon tank capacity as equivalent to one-half square foot of direct radiation.

For submerged heaters without storage tank, size of boiler to be increased as follows: For each gallon of water to be heated per hour add four square feet of direct radiation.

Rule for Computing Net C. I. Column Radiation Equivalent Load for Boilers Selected from Net Load Chart

EXAMPLE—

- (1) 500 sq. ft. of direct cast iron column radiation in room to be heated to 70° F.
- (2) 500 sq. ft. of direct cast iron column radiation in room to be heated to 50° F.
- (3) 500 sq. ft. of cast iron wall radiation or wall pipe coils in room to be heated to 50° F.
- (4) 500 sq. ft. of gravity indirect radiation.
- (5) 500 sq. ft. of direct-indirect radiation.
- (6) 250-gal. hot water tank. Water to be heated with steam coil.
- (7) 500 sq. ft. of cast iron hot blast radiation, having a condensation rate of 1.92 lbs. of steam per hour per sq. ft. with incoming air at — 10° F.

SOLUTION—

- (1) 500 sq. ft. x 1.0..... 500 sq. ft.
- (2) 500 sq. ft. x 1.13..... 565 " "
- (3) 500 sq. ft. x 1.25x1.13..... 707 " "
- (4) 500 sq. ft. x 1.5..... 750 " "
- (5) 500 sq. ft. x 1.25..... 625 " "
- (6) 250 gal. x 2..... 500 " "
- (7) (500x1.92) divided by .375...2560 " "

C. I. column radiation equivalent load6207 sq. ft.

CHIMNEYS

Due to the wide variation in boiler design, the length and nature of the gas passage, the nature of the fuel burned and the rate of combustion all of which affects directly the draft pressure required, it is recommended that the chimney sizes given by the various manufacturers for their boilers be used for both round and square sectional cast iron boilers. It is advisable that chimney have approximately 25 per cent excess area of smoke collar on the boiler.

A poor draft means imperfect combustion, therefore it is highly important that all boilers be attached to chimneys providing sufficient draft to consume with proper combustion the required amount of fuel per hour.

It is also important that the chimney be so located with reference to adjacent buildings or objects nearby that draft will not be interfered with.

Round flues will give a better draft than a square or other rectangular shape, having the same cross-sectional area. Round flues are recommended where it is practical to obtain them.

To secure the most satisfactory draft conditions, the area and the height of a chimney must be proportioned to the size and character of heating appliance attached to it and all flue chimney connections made perfectly tight.

RECOMMENDATIONS

It is recommended that no boiler be installed having a grate longer than 72 inches.

Also that in all installations of steam boiler that drain valves be placed on the returns and that the condensation from such returns be discharged into the sewer for a period of from three days to one week after starting fire, thereby clearing system of grease and dirt. At the end of this period boiler should be thoroughly washed and blown out.

For net loads for boilers communicate with the Chicago Master Steam Fitters' Association. Phone Franklin 6280—228 N. La Salle Street.

The Dunham Differential Vacuum Heating System

The principle of the Dunham Differential Vacuum Heating System is based on the fundamental laws of heat flow and heat processes. The basis of the theory is briefly summed up in the statement of its object—to maintain steady temperatures inside a building throughout the heating season, irrespective of the daily and hourly fluctuations of the outside weather.

The temperature of the steam is governed by the Dunham control equipment and the Dunham Differential Vacuum Pump, which removes the air from the system, thereby reducing the pressure on the water in the boiler, or causing the steam to expand through reducing valves when they are used.

No Complicated Equipment Required

The Differential Vacuum Heating System accomplishes this without any complicated or delicate equipment, or any greater variety of appliances than is used by the ordinary vacuum return line heating system. No larger or special boiler is required on this system than on any other. Any type of boiler suitable for heating work and of high efficiency can be used.

Easily Adaptable to Change-Over from Existing Vacuum Return Line Systems.

An ordinary, well-designed, vacuum return line system can be changed over to the Dunham Differential System. Radiation does not have to be disturbed and in most instances existing piping may be used with only slight changes.

Steam is supplied at variable temperatures from 133° up to 212° and higher, if so required. The 133° temperature corresponds to 25 in. of vacuum (at sea level), and 212° to zero on the gauge. By furnishing steam at this wide range of temperatures, and by partially filling radiation with steam under high vacuum during mild weather, it is possible to vary the best output of the radiation thus preventing overheating.

"Zone" Temperature Control

Enables the engineer to know temperature conditions in the building and to regulate by zones the temperature on various parts of the structure. It provides the flexibility which yields economies and comfort.

C. A. DUNHAM CO.

DUNHAM BUILDING
450 East Ohio Street, Chicago

Over eighty sales offices in the United States, Canada and the United Kingdom bring Dunham Heating Service as close to you as your telephone. Consult your telephone directory for the address of our office in your city. An engineer will counsel with you on any project.



The Dunham Differential Vacuum Heating System and individual parts of the apparatus used in that system are fully protected by United States Patents Nos. 1,641,114, 1,706,401, 1,727,965, 1,761,819 and 1,771,077 and Canadian Patents Nos. 282,193, 282,194 and 282,195. Additional patents in the United States, Canada and foreign countries are now pending.

CHICAGO MASTER STEAM FITTERS ASSOCIATION REFRIGERATION STANDARDS

The following tables are compiled by the Chicago Master Steam Fitters' Association and are recommended for the use of its members.

The intent of these recommendations is to encourage the members of the Chicago Master Steam Fitters' Association to use standards that will aid the installation of refrigerating systems in accordance with the best engineering practice.

To arrive at the factors involved, the Association has endeavored to use factors that recognize superior design of mechanical equipment and that will encourage better application to bring about improved operating performance.

Formulation of the factors shown in the various tables is the result of an extensive survey and study of operating systems.

Table 1 is for calculating the capacity of a compressor in terms of pounds of refrigeration per twenty-four hours. Determine the displacement of the compressor, to be used, in terms of cubic inches per minute as calculated from the bore, stroke, number of cylinders and R. P. M. This displacement divided by the figures shown in Column 7 opposite the kind of refrigerant used, gives a quotient in terms of tons of refrigeration per twenty-four hours. To convert into pounds of refrigeration per twenty-four hours multiply the quotient by two thousand.

Table 2 states the pounds of refrigeration of compressor capacity that should be allotted to each refrigerator cabinet of a given gross cubic content as determined by Table 6. Minimum insulation two inches thick.

It is not intended that air cooled condensers shall be discouraged, but experience shows that building space in most instances does

not permit operation under normal conditions.

Table 3 shows the cooling unit capacity, for a given size refrigerator, in terms of minimum square feet of active external surface and pounds of refrigeration per twenty-four hours, exclusive of ice cube freezing capacity. See Table 4 for itemized load.

Table 4 shows the average square feet of external surface for a refrigerator of given size and the last line shows the total refrigerating load created by full demand from the refrigerator.

Table 5 shows the importance of sufficient insulation, for example, two inches or more of approved insulation, compared with one and one-half inches, or less, will show a substantial annual saving in power cost at the average rates for electric energy.

Table 6 is for convenience and uniformity in determining the gross cubical contents of refrigerator cabinets.

Example:—A compressor is two cylinder, single acting $2\frac{1}{2}$ " bore, 3" stroke, 360 R.P.M. water cooled condenser, using sulphur dioxide as a refrigerant. What is its capacity, how many 5 cubic feet gross, refrigerators with 2" insulation will it cool, and what cooling unit surface is necessary?

$[(2.5)^2 \times .7854 \times 3"]$ stroke \times 2 cylinders \times 360 R. P. M.] equals 10603 cubic inches displacement per minute. Divide 10603 by 20736 cubic inches from Table 1, Column 7 and the quotient is .51 of a ton or 1020 pounds of refrigeration per 24 hours. Divide 1020 pounds by 55 pounds from Table 2 and the quotient is 18 refrigerators. From Table 3 we learn that the 5 cubic foot refrigerator requires a cooling unit having a minimum of 4 square feet of active external surface.

TABLE NO. 1. COMPRESSOR RATING 24 HOURS.

Kind of Refrigerant	Suction		Discharge		Max. R.P.M.	Max. Per Min Piston Speed	Per Min. Per Ton Displacement	
	Pres. Lbs. Gage	Temp. Deg. F.	Pres. Lbs. Gage	Corres. Temp. Deg. F.			cubic inches	cubic feet
Carbon Dioxide CO_2	317	5°	1025	86	375	400	1200	0.7
Ammonia NH_3	19.8	5°	153.8	86	375		6912	4.0
Methyl Chloride CH_3CL	6.2	5°	80.8	86	375		13824	8.0
Sulphur Dioxide SO_2	-2.8	5°	51.2	86	375		20736	12.0
Column No	1	2	3	4	5	6	7	8

Note 1.—Ammonia Compressors of one ton and over by above Table No. 1 shall rate for Methyl Chloride on a basis of $7\frac{1}{2}$ Cubic Feet per minute per ton.

TABLE NO. 2 Pounds per 24 hours of Compressor Capacity to Allow per Cabinet	Condenser cooled by	Gross Cubic Feet inside Refrigerator Cabinet													
		4	5	6	7	8	9	10	12	14	16	20	25	30	
	Water	50	55	63	67	83	88	100	117	124	137	174	185	200	
Air	60	66	75	87	100	110	120	140	150	165	210	225	240		

Note—Table 2 is based on 2-inch minimum insulation, of material averaging 7 B.T.U. per degree, per square foot, per 24 hours for one inch thickness.

TABLE NO. 3	Gross Cubic Feet inside Refrigerator												
Cooling Units	4	5	6	7	8	9	10	12	14	16	20	25	30
Average wt. ice cubes in lbs. per freeze	3	3	4	4	6	6	7	9	9	10	15	15	15
Minimum sq. ft. surface active Cooling Cabinet	3.5	4	4.3	4.6	5.3	5.6	6.5	7.2	8	8.5	9.7	11	12.5
Capacity lbs. refg. per 24 hours. T-t=25° F.	35	40	43	47	53	58	65	72	79	85	98	109	124

Note—Table 3. Cooling unit surface and capacity does not include ice freezing load. See Table 4.

Beauty...Efficiency...Undivided Responsibility



American Radiator Heating Equipment for Every Requirement

No man, buying an automobile, purchases a certain make of carburetor, a certain make of radiator and so on, and has his car assembled. He buys a car the parts of which are designed to function as an efficient unit.

In the past, however, such has been the custom in the purchase of heating. A boiler from this company, radiators from that, valves from a third. No wonder there are often imperfect coordination among the parts.

Conscious of the need for undivided responsibility, the American Radiator Company has made it possible, by its complete line of products, to buy every part of a

heating system from one manufacturer. It guarantees the heating plant in its entirety.

The success of a heating system depends largely on its accessories. The best boiler and radiators may be handicapped by inferior valves. For this reason it is important that accessories be used which have been made especially for a particular radiator, and designed to play their part in the development of the highest efficiency for the whole plant.

To its guarantee of undivided responsibility, American Radiator Heating Equipment adds the efficiency developed through forty years' experience—and great beauty and distinction in line and color.

AMERICAN RADIATOR COMPANY

816 SO. MICHIGAN AVE., CHICAGO, ILL.

TABLE NO. 4—Itemized refrigerator load in pounds of refrigeration per 24 hours. Total load shown by last line.

	Gross Cubic Feet inside Refrigerator												
	4	5	6	7	8	9	10	12	14	16	20	25	30
Sq. Ft. Exterior Surface.....	24	28	30	33	36	40	44	49	54	58	67	75	84
Wall.....lbs.	30	34	36	40	44	49	54	60	66	71	82	91	102
Food and Service.....lbs.	5	6	7	7	9	9	11	12	13	14	16	18	22
Ice 2 freezers 12 hours.....lbs.	15	15	20	20	30	30	35	45	45	52	76	76	76
Total Load.....lbs.	50	55	63	67	83	88	100	117	124	137	171	185	200

TABLE NO. 5—Pounds of refrigeration per 24 hours per square foot of surface.

For insulating materials averaging 7 B.T.U. per degree per sq. foot per 24 hours, 1 inch thick 50° F. difference	Inches thick	1½	2	2½	3	3½	4	5	6
	Lbs. per sq. ft.	1.62	1.21	.97	.81	.69	.60	.48	.40

TABLE NO. 6 Cubic feet per inch of height

Example for refrigerator 20" wide 16" deep 30" high. Start on line showing 20" wide read right to column marked 16" deep. .185 is cubic feet per inch of height. Multiply this number by 30" and result is 5.55 cubic feet in refrigerator.

Inside dimensions Inches wide	Inside dimensions - INCHES DEEP - front to back											
	13	14	15	16	17	18	19	20	21	22	23	24
16	.120	.129	.138	.148	.157	.166	.176	.186	.194	.203	.213	.222
17	.128	.137	.147	.157	.167	.177	.187	.196	.206	.216	.226	.236
18	.135	.145	.156	.166	.177	.187	.198	.208	.218	.229	.239	.250
19	.143	.154	.165	.176	.187	.198	.209	.220	.231	.242	.253	.264
20	.150	.162	.173	.185	.197	.208	.220	.231	.243	.255	.266	.278
21	.158	.170	.182	.194	.207	.218	.231	.243	.255	.267	.280	.292
22	.165	.178	.191	.203	.216	.229	.242	.254	.267	.280	.293	.306
23	.173	.186	.199	.213	.226	.239	.253	.266	.280	.293	.306	.320
24	.180	.194	.208	.222	.236	.250	.264	.278	.292	.306	.319	.334
25	.188	.202	.217	.231	.246	.260	.275	.289	.304	.318	.333	.348
26	.195	.210	.225	.240	.256	.271	.286	.301	.316	.331	.346	.362
27	.203	.218	.234	.250	.266	.281	.297	.312	.328	.344	.359	.376
28	.210	.227	.243	.259	.275	.292	.308	.324	.340	.357	.373	.389
29	.218	.235	.252	.268	.285	.302	.319	.336	.352	.369	.386	.403
30	.225	.243	.260	.278	.295	.312	.330	.347	.364	.382	.399	.417
31	.233	.251	.269	.287	.305	.323	.341	.359	.377	.395	.412	.431
32	.240	.259	.278	.296	.315	.333	.352	.370	.389	.408	.426	.445
33	.248	.267	.286	.305	.325	.344	.363	.382	.401	.420	.439	.459
34	.256	.275	.295	.314	.334	.354	.374	.394	.413	.433	.452	.473
35	.263	.283	.304	.324	.344	.365	.385	.405	.425	.446	.465	.487
36	.271	.291	.312	.333	.354	.375	.396	.416	.437	.459	.479	.500
37	.278	.300	.321	.342	.364	.385	.407	.428	.450	.472	.492	.514
38	.286	.308	.330	.352	.374	.396	.418	.440	.462	.485	.506	.528
39	.293	.316	.338	.361	.384	.406	.429	.452	.474	.497	.519	.542
40	.301	.324	.347	.370	.394	.416	.440	.463	.486	.510	.533	.556
41	.308	.332	.356	.380	.403	.427	.451	.475	.498	.523	.546	.570
42	.316	.340	.364	.389	.413	.437	.462	.486	.510	.535	.560	.584
43	.323	.348	.373	.399	.423	.447	.473	.497	.522	.547	.573	.598
44	.331	.356	.382	.407	.433	.458	.484	.509	.535	.560	.586	.612
45	.338	.364	.390	.416	.443	.468	.495	.520	.547	.573	.599	.626
46	.346	.372	.399	.426	.453	.479	.506	.532	.559	.586	.612	.640
47	.354	.381	.408	.435	.463	.490	.517	.544	.571	.599	.626	.654
48	.361	.389	.417	.445	.472	.500	.528	.555	.583	.612	.640	.668

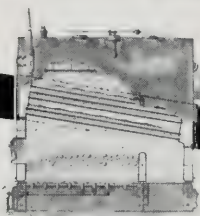
Use even inches nearest actual dimensions of refrigerator.

The KNOWLTON WATERTOOL STEEL HEATING BOILER

Designed Especially for
MODERN MECHANICAL
HEATING

Direct Draft

COPPER-BEARING
STEEL
TUBES

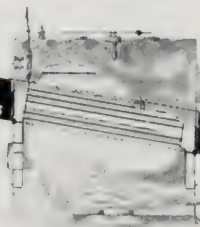


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HEATING
SURFACE

**FOR EVERY
HEATING
NEED -**

for Oil and Gas

SUPER-
SENSITIVE
COPPER-TUBES



QUICK HEAT
ON THE CYCLE
OF OPERATION

**ECONOMY and
DURABILITY
ASSURED**

Specialization—the password of the modern age—has been applied right-fully to heating.

Selecting a particular type boiler for the particular type installation is as important a factor in good heating engineering as the actual installation itself.

Knowlton Boilers cover the varied specifications as perfectly as they burn fuel. Their employment denotes, not only thorough heating knowledge, but also shrewd judgment in economy.

ORR & SEMBOWER, INC.

READING, PENNSYLVANIA

208 N. Clinton St., Chicago 50 Church St., New York



COMPLETE · HEATING · SATISFACTION

MINIMUM HEAD ROOM REQUIREMENTS FOR SMOKELESS SETTINGS.

BOILERS

Furnaces	Horizontal Return Tubular				Water Tube				Scotch Marine		
	54"	60"	66"	72"	Hor. Baff. 1'-1 1/2" Pitch	Vert Baff. 1'-1 1/2" Pitch	Hor Baff. 3 1/4" Pitch	Vert Baff. 3 1/4" Pitch			
Hand Fired	Shell to Dead Plate	Shell to Dead Plate	Shell to Dead Plate	Shell to Dead Plate	Front Header to Floor						
	No. 6.....	32"	34"	34"	36"	**6'0"	*	**6'6"	*	##	
	No. 7 (Modified)...	32"	34"	34"	36"	=	=	=	=	##	
	No. 8.....	32"	34"	34"	36"	6'0"	*	6'6"	*	##	
	Hand Stoker.....	26"	28"	28"	30"	5'6"	*	6'0"	*	Full Extension	
	Down Draft.....	60"	60"	60"	60"	6'0"	*	6'6"	*	Full Extension	
	Twin Fire.....	58"	60"	62"	64"	6'0"	*	6'6"	*	*	
Semi Ext. Refuse Burning.....	44"	46"	46"	48"	7'0"	*	7'6"	*	*		
	Gravity Feed	Burke.....	48"	48"	50"	54"	5'0"	*	5'6"	*	Full Extension
		McMillan.....	48"	48"	50"	54"	5'0"	*	5'6"	*	Full Extension
Twin Fire..... (Gravity)		48"	48"	50"	54"	5'0"	*	5'6"	*	Full Extension	
Chain Grates.....	72"	72"	78"	78"	7'0"	9'0"	8'0"	10'0"	##		
Front Feed	Moore.....	48"	54"	60"	60"	6'0"	8'6"	6'6"	9'0"	##	
	Roney.....	60"	60"	60"	72"	7'0"	9'0"	7'6"	10'0"	##	
	Wetzel.....	60"	60"	60"	72"	7'0"	9'0"	7'6"	10'0"	##	
Side Feed	Detroit.....	66"	72"	78"	84"	7'6"	*	8'0"	*	Full Extension	
	Model.....	66"	72"	78"	84"	7'6"	*	8'0"	*	Full Extension	
	McKenzie.....	66"	70"	70"	70"	7'6"	*	8'0"	*	Full Extension	
	Murphy.....	66"	72"	78"	84"	7'6"	*	8'0"	*	Full Extension	
Underfeed	Type "E".....	##	##	##	##	6'6"	8'6"	7'6"	9'0"	##	
	Jones.....	36"	38"	40"	42"	6'0"	8'0"	7'0"	8'6"	Min Diam.	
	Detroit.....	42"	44"	46"	48"	6'6"	8'6"	7'6"	9'0"	Furnace 36"	
	Taylor.....	##	##	##	##	6'6"	8'6"	7'6"	9'0"	##	
	Sanford-Riley.....	##	##	##	##	6'6"	8'6"	7'6"	9'0"	##	
	Westinghouse.....	##	##	##	##	6'6"	8'6"	7'6"	9'0"	##	
NOTES		* Combinations not recommended as smokeless settings = Not adapted to water tube boilers. ## Combinations not ordinarily met with in practice ** Omit double arches—using only deflection arch. Setting heights for Jones stoker refer to standard stoker									

The accompanying table is intended to show the minimum setting heights for the various combinations of boilers and furnaces found in use in Chicago.

These settings are not intended for high capacities, but have proven satisfactory for normal loads where draft is sufficient and proper methods of operation used.

The setting heights shown for side feed stokers are for furnace widths of 7' 0" or less.

For wider furnaces the heights must be increased to allow for increased arch spring necessitated by the wider span.

Combinations of vertically baffled water tube boilers noted as not being recommended as smokeless settings have been found in actual operation to produce too much smoke to comply with the smoke ordinance in its strictest interpretation, and have proven unsatisfactory from the Smoke Inspector's viewpoint.

Milwaukee Valve Company

"MILVACO" Heating Specialties

Burrell and Chase Streets

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JACKSON, MISS.

Packless Valves

NOTE.—In addition to types illustrated, Dole-Milwaukee Packless Valves can be furnished in the following patterns:

Lock and Shield Angle.
Lock and Shield Graduate.
Union Gate.
Union Globe and Right and Left Hand Corner.
Always specify steam or water.

Send for Bulletin No. 24

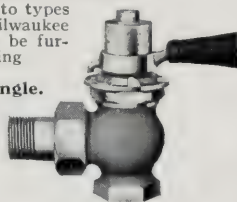


Fig. 209-M
Lever Handle Graduate



Fig. 215-M
Quick Opening Angle

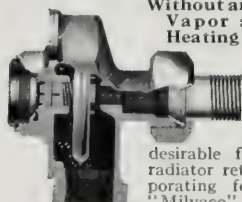


Fig. 210-M
Knob Handle Graduate

All patterns made in sizes $\frac{1}{2}$ to 2 in. inclusive.

Thermostatic Trap

Without an equal for Vacuum, Vapor and Modulating Heating Systems.



Illustrated below is a sectional view showing construction of "Milvaco" Thermostatic Traps.

Embodying every desirable feature of successful radiator return traps and incorporating features exclusive in "Milvaco" traps, this product is

a most desirable asset to a heating system. Send for Bulletin No. 23.

Roughing-in Dimensions and Capacities

Fig. No.	Capacity Sq. Ft. Rad.	Pipe Conn.	A Center Line Outlet to End of Spud	B Face of Outlet to Center of Spud
0	75	$\frac{1}{2}$ "	$2\frac{1}{4}$ "	$1\frac{1}{8}$ "
1	200	$\frac{3}{4}$ "	$3\frac{1}{4}$ "	2"
2	500	$\frac{1}{2}$ "	$3\frac{1}{4}$ "	$2\frac{1}{8}$ "

NOTE.—The standard roughing-in dimension, "A" for $\frac{1}{2}$ in. traps as adopted by the Heating and Piping Contractors' National Association, is $3\frac{1}{4}$ in. which standard we adhere to. We can, however, upon special request, supply traps with this dimension any length from $2\frac{3}{4}$ to 4 in.

Send for Bulletins showing complete line of specialties.

"Milvaco" Air Eliminator

A heavy substantial float vent for use on heating systems or apparatus where rapid elimination of air is necessary, and where passage of both steam and water must be prevented.

Made in $\frac{1}{4}$ to $\frac{3}{4}$ in. sizes.

Send for Bulletin No. 26



"Milvaco" Quick Vent

For use at high points on any installation where a large volume of air must be rapidly vented.

A large substantial vent for heavy duty service.

Vents completely at high or low pressures, and the check valve prevents the return of air into the system.

Construction the same as Air Eliminator, eliminating the float.

Made in $\frac{1}{2}$ and $\frac{3}{4}$ in. sizes.

Send for Bulletin No. 26



"Milvaco" Boiler Return Trap

An ideal trap for use on vapor systems for returning water of condensation to the boiler. Positive in action; noiseless in operation; and mechanism not dependent upon action of springs.

Capacity 4000 sq. ft. direct radiation.

Pipe connection 2 in.

Steam and Vent connections $\frac{1}{2}$ in.

Send for Bulletin No. 25



"Milvaco" Drip and Blast Traps

"Milvaco" Drip and Blast Traps are a combination float and thermostatic trap which drip any main or riser on any heating system or apparatus where it is necessary to positively eliminate both air and water and close against steam. Not dependent upon temperature for action. Guaranteed to eliminate drip troubles.

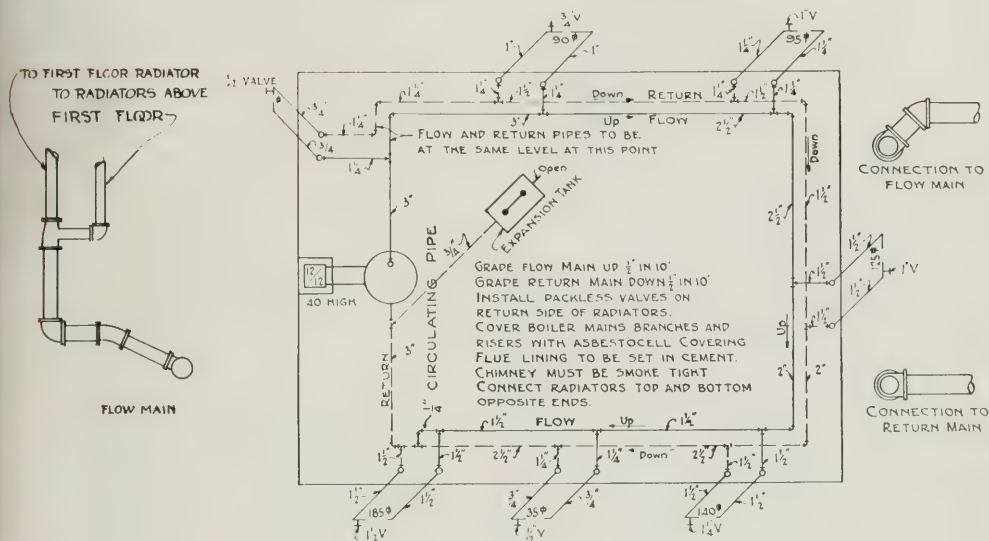


Made in $\frac{1}{2}$ to 2 in. sizes, inclusive.

Send for Bulletin No. 27.

TWO-PIPE NON-SHORT CIRCUIT HOT WATER HEATING SYSTEM

HOMER R. LINN, Mechanical Engineer, Member American Society Heating and Ventilating Engineers



Gravity hot water heating systems may be divided into two general heads, viz.: Short circuit systems and non-short circuit systems. These may be subdivided into up feed, down feed, etc.

In the short circuit system the flow and return mains run parallel, grade up away from the boiler and are of corresponding sizes where any radiator is taken off. The first radiator taken off of the flow main is also the first radiator on the return main. We, therefore, have the greatest push or pressure on the flow main and the greatest pull on the return main at this point. The result is that the tendency of all of the hot water is to go through this radiator, while the one on the farther end of the main has less pressure and therefore is sluggish. Various means are resorted to in overcoming this error, such as putting lead washers in the valve unions, taking flow connection off of the side of the main, etc. Any of these are uncertain and often cause trouble which is hard to locate.

In the non-short circuited system the flow main grades up away from the boiler. Where the connection to the first radiator is taken off of the flow main, the connection from the return of this radiator is brought into the end of the return main. In other words, this is the smallest diameter of the return main. It will be seen that we have here the greatest push on the flow main and the least pull on the return main. At this point both mains should be on the same level, but from here on the return main should grade down one-half inch in ten feet, while the flow main should continue to grade up one-half inch in ten feet. The last radiator taken off of the flow main will be the nearest radiator to the boiler on the return main. Therefore, at this point we have the least push in the flow main but the greatest pull in the return main. Thus it will be seen we have no short circuits, but a balanced condition throughout.

The accompanying sketch illustrates how the proper sizes of valves and pipes may be selected from the table. It also shows the best method of making connections to the flow main and also to the return main.

Unless boilers are furnished with integral metal insulating jackets, they should be well covered with a plastic covering having an air space between the boiler and the covering. All mains, branches and risers should be covered with a good grade of moulded covering. The expansion tank pipe may be taken off from either the flow or the return main, whichever is most convenient.

GRAVITY HOT WATER HEATING.

Sizes of mains for basement two-pipe non-short circuit system where mains are not over 100 feet long.

1 1/4"	pipe,	0 sq. ft. to 100 sq. ft.
1 1/2"	pipe,	101 sq. ft. to 250 sq. ft.
2"	pipe,	251 sq. ft. to 400 sq. ft.
2 1/2"	pipe,	401 sq. ft. to 650 sq. ft.
3"	pipe,	651 sq. ft. to 1000 sq. ft.
3 1/2"	pipe,	1001 sq. ft. to 1900 sq. ft.
4"	pipe,	1901 sq. ft. to 2500 sq. ft.
4 1/2"	pipe,	2501 sq. ft. to 3100 sq. ft.
5"	pipe,	3101 sq. ft. to 4000 sq. ft.
6"	pipe,	4001 sq. ft. to 5600 sq. ft.

Sizes of Risers.

3/4"	pipe,	0 sq. ft. to 70 sq. ft.
1"	pipe,	71 sq. ft. to 120 sq. ft.
1 1/4"	pipe,	121 sq. ft. to 180 sq. ft.
1 1/2"	pipe,	181 sq. ft. to 250 sq. ft.

Sizes of Valves.

1/2"	valve,	0 sq. ft. to 60 sq. ft.
3/4"	valve,	61 sq. ft. to 90 sq. ft.
1"	valve,	91 sq. ft. to 130 sq. ft.
1 1/4"	valve,	131 sq. ft. to 180 sq. ft.
1 1/2"	valve,	181 sq. ft. to 250 sq. ft.

Grade Flow main up and Return main down. 1/2" in 10 ft.

MARSH

truly modern heating
... a triumph of our times

FOR over sixty-five years Jas. P. Marsh & Company has maintained a nation-wide reputation for producing heating systems, heating specialties and instruments of outstanding merit both in excellence of design and in quality of workmanship.

This acknowledged leadership, backed by the progressive quality of Marsh engineering, has won a hearty public acceptance that is a tribute to the proved accuracy, certainty of control and consequent fuel economy of all Marsh products. For full details of the complete Marsh line, see Sweet's Architectural Catalogues, Volume D, pages 5601 to 5690.

The comprehensive Marsh engineering service is always at your command.

JAS. P. **MARSH** & CO.

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SMOKE ORDINANCE

(Smoke Inspection Department, City of Chicago)

Be it ordained by the City Council of the City of Chicago:

Section 1. Department of Smoke Inspection and Abatement Established). There is hereby established a Department of the municipal government of the City of Chicago which shall be known as the Department of Smoke Inspection and Abatement. The said Department shall embrace a Smoke Inspection and Abatement Commission composed of the Commissioner of Health as chairman, the Commissioner of Buildings, the Corporation Counsel, the Commissioner of Police, and the chief inspector of Steam Boilers and Steam Plants. There shall also be employed, according to law, a Deputy Smoke Inspector in Charge and such other employes as the City Council may provide in the annual appropriation ordinance.

Section 2. Smoke Inspection and Abatement Commission—Duties). It shall be the duty of the Smoke Inspection and Abatement Commission to establish standards, rules and regulations in accordance with the express terms and provisions of this ordinance, for the inspection and control of the installation, reconstruction, alteration, repair and maintenance of heating, power and fuel burning equipment; the prevention and abatement of smoke and noxious gases, and nuisances arising therefrom, the examination and approval of plans of all heating, power and fuel burning installations and of all smoke prevention and abatement installations installed or reconstructed in any building, location or on any premises within the jurisdiction of the City of Chicago.

Section 3. Deputy Smoke Inspector in Charge—Qualifications—Duties). The Deputy Smoke Inspector in Charge shall be an engineer qualified by technical training and experience in the theory and practice of the construction and operation of steam boilers and fuel burning equipment and also in the theory and practice of smoke abatement and prevention. It shall be the duty of the Deputy Smoke Inspector in Charge, under the direction and supervision of the Smoke Inspection and Abatement Commission, to supervise the work of all employes of the department herein created, and to carry into execution the law and ordinances pertaining to smoke prevention and abatement and the installation, reconstruction, alteration and repair of fuel burning equipment, and the standards, rules and regulations adopted by the Smoke Inspection and Abatement Commission.

Section 4. Bond). The Deputy Smoke Inspector in Charge, before entering upon the duties of his office, shall execute a bond to the city in the sum of five thousand dollars with sureties to be approved by the Com-

troller, conditioned for the faithful performance of the duties of his office.

Section 5. Construction and Reconstruction of Plans and Specifications—Permit). No new fuel burning plants nor reconstruction or any existing fuel burning plants for producing power and heat, nor either of them, nor refuse burning, nor any new chimney connected with such fuel burning plant, shall be installed, erected, reconstructed or maintained in the City of Chicago until plans and specifications of the same have been filed in the office of and approved by the Deputy Smoke Inspector in Charge and a permit issued by him for such installation, erection, reconstruction or maintenance. Plans and specifications shall be filed with the Deputy Smoke Inspector in Charge, which said plans shall show the type of installation, the amount of work and the amount of heating to be done by such fuel burning plant and all appurtenances thereto, including all provisions made for the purpose of securing complete combustion of the fuel to be used and for the purpose of preventing smoke. Said plans and specifications shall also contain a statement of the amount and kind of fuel proposed to be used and said plans and specifications shall also show that the room or premises, in which such fuel burning plant shall be located, is provided with doors, windows, air-shafts, fans and other means of ventilation sufficient to prevent the temperature of such room, basement or other portion of such building wherein such fuel burning apparatus is to be used, from rising to a point higher than 120 degrees Fahrenheit, and sufficient also to provide that the atmosphere of any such room, basement or other part of the building wherein such fuel burning apparatus may be located, may be changed every ten minutes. Such plans shall further show the dimensions of the room in which such fuel burning apparatus is to be located, the location and dimensions of all chimneys and smoke stacks used in connection with or as a part of said fuel burning plant. Upon the inspection and approval of such plans and specifications by the Deputy Smoke Inspector in Charge, a duplicate set of said plans shall be left on file in the office of said Deputy Smoke Inspector in Charge and upon the payment of the fees as hereinafter provided, and if such plans and specifications shall show that proper provisions for the purpose of securing complete combustion of the fuel to be used and for the purpose of preventing and abating smoke have been made, he shall issue a permit for the installation or for the construction, erection, reconstruction or maintenance of such fuel burning plant. As soon as the Deputy Smoke Inspector in Charge has issued the permit as above provided, it shall be the duty of the various



ILLINOIS THERMAL-ZONE CONTROL

The added refinement of Illinois Thermal Zone control to an Illinois vacuum system is the logical answer to the problem of preventing overheating and fuel waste in large buildings—or groups of buildings heated from one central power plant.

An Illinois Thermal-Zone Control Valve is installed in branch mains and controlled by a thermostat in the zone or section heated by such mains. The valve will shut off when zone is up to temperature and open when temperature at thermostat falls.

This stops all overheating and steam waste by controlling the steam not only in the radiator but **ALSO ON THE PIPING**—therefore effecting an additional saving over systems controlling only the radiators.

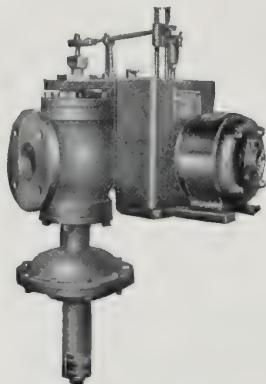
Buildings may be zoned as to occupancy; as

to time (Program and Cycle); geographic location; exposure, wind and sun; and so on.

The system in addition can be arranged to control the operation of fuel burner and vacuum pump. The fuel burner operated automatically in accordance with steam demand, and the vacuum pump automatically controlled to start and maintain vacuum in returns, or stop, according to operating demands. The system also gives push button control from a panel board in engineer's or superintendent's office.

An Illinois Thermal-Zone Control System will pay for itself in one or two heating seasons.

The system is entirely automatic in operation. No adjustments are required by engineer for varying pressures or temperatures. The installation is regular, the apparatus simple, as all zones are operated from **ONE** pump and not a separate pump on each zone.



Illinois Thermal-Zone Control Valve

In addition to special Vacuum and Vapor heating appliances we manufacture a complete line of specialties for the automatic control of steam. This enables us to use the proper device to secure results under widely varying conditions in **EVERY** type of building. With balanced parts of our own manufacture, designed to work in unison, we **GUARANTEE SATISFACTORY RESULTS.**

ILLINOIS PRODUCTS

Radiator Traps
Modulating Valves
Low Pressure Boiler
Return Traps
Pressure
Reducing Valves
Heat Retainers
Thermal-Zone Control Valves

High and Low
Pressure Steam Traps
Blast Traps
Separators
(Oil and Steam)
Back Pressure Valves
Expansion Joints

Write for bulletins



departments having charge of the inspection of the premises wherein said fuel burning apparatus is located to cooperate with the said Deputy Smoke Inspector in Charge; to see that the execution of the work so permitted by said permit shall be done in conformity with the plans and specifications submitted and approved, and the standards, rules and regulations fixed by said Smoke Inspection and Abatement Commission.

Section 6. Use of Plant—Certificate of Deputy Smoke Inspector in Charge Required). It shall be unlawful for any person to use any new or reconstructed plant for the production and generation of heat and power, or either of them, until he shall have first procured a certificate from the Deputy Smoke Inspector in Charge certifying that the plant is so constructed that it will do the work required, and that it can be so managed that no dense smoke shall be emitted from the chimney connected with the furnace or fire-box, in violation of the provisions of this ordinance.

Section 7. Chimneys and Furnaces—Repairs—Permit Required—Penalty). No owner shall install, alter or repair any chimney or any furnace or device, which alteration, change or installation would affect the method or efficiency of preventing and abating smoke, without first submitting plans and specifications to the Deputy Smoke Inspector in Charge and securing a permit therefor, nor shall any owner alter or repair any brickwork on or about a high pressure boiler without first submitting plans and specifications to the Deputy Smoke Inspector in Charge and securing a permit therefor. Any person, firm or corporation who shall violate this Section shall be liable to a fine of \$25.00 for each day upon which he or they shall prosecute such alteration, change or installation without a permit and each day's violation shall constitute a separate offense.

Section 8. Fees—When Remitted). The fees for the inspection of plans and issuing of permits, and for the inspection of furnaces or other fuel-burning apparatus or devices, and issuing of certificates, shall be as follows:

For inspecting plans of new plants and of plants about to be reconstructed, two dollars.

For inspecting plans for repairs and alterations, one dollar.

For permits for the erection, installation, reconstruction, repair or alteration of any furnace or other fuel-burning apparatus, smoke-prevention device or chimney, five dollars for each unit, or single apparatus.

For examining or inspecting any new or reconstructed furnace connected to a high pressure boiler after its erection or reconstruction and before its operation and maintenance, five dollars for the first unit or single apparatus, and three dollars for each additional unit or single apparatus.

For examining or inspecting any new or reconstructed furnace connected to a low pressure boiler or any other fuel-burning equipment, or any smoke-prevention device, after its erection or reconstruction and before its operation and maintenance, three dollars for each unit or single apparatus.

Provided, however, that this Section shall not apply to furnaces or other fuel-burning apparatus or devices installed or used to heat private residences, tenements or buildings consisting of two apartments or less.

The aforesaid fees shall be paid to the City Collector prior to the approval of plans for such installations by the Deputy Smoke Inspector in Charge.

The fee for the examination or inspection shall include the issuing of a certificate for operation in case such certificate for operation is granted and shall be paid at the time the permit is secured.

The Deputy Smoke Inspector in Charge may and he is hereby directed and instructed to remit all inspection or examination fees charged against any and all charitable, religious and educational institutions, when the furnace or other device or apparatus inspected is located in or upon premises used and occupied exclusively by such charitable, religious or educational institution; provided that such charitable, religious or educational institution is not connected or carried on for private gain or profit; and provided further that the Deputy Smoke Inspector in Charge may require every application for the remission of such fees to be verified by the affidavit of one or more taxpayers of the City.

Section 9. Emission of Dense Smoke—Regulation—Penalty). The emission of dense smoke within the city from the smoke stack of any locomotive, steam boat, steam tug, steam roller, steam derrick, steam pile driver, tar kettle or other similar machine or contrivance or from any open fire or from the smoke stack or chimney of any building or premises except for a period of or periods aggregating six minutes in any one hour at the time when the fire-box is being cleaned out or a new fire being built therein, is prohibited and is hereby declared to be a nuisance and may be summarily abated by the Deputy Smoke Inspector in Charge or by anyone whom he may duly authorize for such purpose. Such abatement may be in addition to the fine hereinafter provided. Any person, firm or corporation owning, operating or in charge or control of any locomotive, steam boat, steam tug, steam roller, steam derrick, steam pile driver, tar kettle or other similar machine or contrivance or any open fire or of any building or premises, who shall cause or permit the emission of dense smoke within the City of Chicago from the smoke stack or chimney of any such locomotive, steam boat, steam tug, steam roller, steam derrick, steam pile driver, tar kettle or other similar machine or contrivance or any open fire or from the smoke stack or chimney of any building controlled or in charge of him, her or them, except for a period of or periods aggregating six minutes in any one hour at the time when the fire-box is being cleaned out or a new fire being built therein, shall be deemed guilty of a violation of this Section and upon conviction thereof shall be fined not less than ten dollars nor more than one hundred dollars for each offense, and each emission of dense smoke in violation of the provisions of this Section shall constitute a separate offense for each and every day on which such violation shall continue.

Section 10. Dust, Soot, Noxious Gases, Abatement). No person or persons, firm or corporation shall cause, permit or allow the escape from any smoke stack or chimney into the open air of such quantities of ash dust, soot, cinders, acid or other fumes, dirt or other material or noxious gases in such place or manner as to cause injury, detriment, nuisance or annoyance to any person or persons or to the public or to endanger the comfort and repose, health or safety of any such person or persons or the public or in such a manner as to cause or have a natural tendency to cause injury or damage to business or property.

Any person or persons, firm or corporation causing, permitting or allowing the escape from any smoke stack or chimney into the open air of such quantities of ash dust, soot, cinders, acid or other fumes, dirt or other material or noxious gases, in such place or manner as to cause injury, detriment, nuisance or annoyance to any person or persons or to the public or to endanger the comfort and repose, health or safety of any such person or persons or the public or in such a manner as to cause or have a natural tendency to cause injury or damage to business or property, shall be deemed guilty of a vio-

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America's Finest Buildings

CHOSE TRANE CONVECTION HEAT

Leading architects learn superiority in this new, economical method of heating.

TRANE installations in 1930 are proof of the trend of prominent architects to the selection of this modern method of heating. They have found that Trane Convection Heaters mean greater economy and comfort to users; that they save space and harmonize with interior decoration; that their first cost is amazingly low for the advantage they bring.

Glance at this list of modern buildings—Trane equipped—and then send for complete information and architectural drawings of the various types of Trane Heaters. There's a size and style to fit every need in homes, offices, hotels, institutions, etc.

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For the best quality and highest economy specify Trane Heating Specialties for vacuum and vapor systems. Also unit heaters, blast heaters and pumps.

Some Prominent 1930 TRANE Equipped Buildings

No. 10 Gracie Square, New York, N. Y.
Apartment Building. *Architects:* Van
Wort & Wein. 938 Trane Concealed
Heater Units Installed.

1616 Walnut Street, Philadelphia, Pa.
Office Building. *Architects:* Tilden, Reg-
ister & Pepper. 523 Trane Concealed
Heater Units Installed.

No. 1 East End Ave., New York, N. Y.
Apartment Building. *Architects:* Pen-
nington & Lewis. 441 Trane Concealed
Heater Units Installed.

Addition to Morrison Hotel, Chicago,
Ill. *Architects:* Holabird & Root. 440
Trane Concealed Heater Units Installed.

New Central Young Men's Christian
Association Building, Akron, Ohio.
Architects: Good & Wagner. 403 Trane
Concealed Heater Units Installed.

Banks-Huntley Building, Los Angeles,
Cal. *Architects:* John and Donald B.
Parkinson. 224 Trane Concealed Heater
Units Installed.

Addition to Southern Pacific Building,
San Francisco, Cal. *Architects:* Coffey
& Rist. 187 Trane Concealed Heater
Units Installed.

Francis Hotel, Monroe, La. *Architects:*
Wyatt C. Hedrick, Inc., Fort Worth,
Texas. 350 Trane Concealed Heater
Units Installed.

Doctors Building, Atlanta, Ga. *Architects:*
Pringle & Smith. 396 Trane Concealed
Heater Units Installed.

Hotel Brownwood, Brownwood, Texas.
Architects: Wyatt C. Hedrick, Inc.,
Fort Worth, Texas. 278 Trane Concealed
Heater Units Installed.

St. Elizabeth Hospital, Chicago, Ill.
Architects: Hermann J. Gaul & Son. 501
Trane Concealed Heater Units Installed.

Loren M. Post School, Detroit, Mich.
Architects: McGrath & Dohmen. 134
Trane Concealed Heater Units Installed.

lation of this Section and upon conviction thereof shall be fined not less than \$10.00 nor more than \$100.00 for each offense and each violation of the provisions of this Section shall constitute a separate offense for each and every day upon which such violation shall continue.

All persons participating in any violation of this provision either as owners, proprietors, lessees, agents, tenants, managers, superintendents, captains, engineers, firemen or janitors or otherwise shall be severally liable therefor, and to the penalties fixed in this ordinance.

Section 11. Violations—Prosecutions). Prosecutions for all violations of this ordinance shall be instituted by the Deputy Smoke Inspector in Charge and shall be prosecuted in the name of the City of Chicago.

The issuance and delivery by the Deputy Smoke Inspector in Charge of any permit or certificate for the construction or reconstruction, or any permit for the alteration or repair of any plant or chimney, connected with a plant, shall not be held to exempt any person or corporation to whom any such permit has been issued or delivered, or who is in possession of any such permit, from prosecution on account of the emission or issuance of dense smoke caused or permitted by any such person or corporation.

Section 12. Penalty). Any person who shall violate any of the provisions of this ordinance (except as herein otherwise provided) shall be fined not less than twenty-five dollars or more than one hundred dollars for each offense.

Section 13. Fraud—Favors—Penalty). If any person acting on behalf of the City under the provisions of this ordinance shall take or receive any money or any valuable thing

for the purpose of deceiving or defrauding any person or persons, or for the purpose of favoring any person or persons, or if any employe shall recommend the issuance of any certificate of inspection without having at the time stated, thoroughly examined and tested the furnace, device or apparatus so certified, he shall be fined one hundred dollars for each offense.

Section 14. This ordinance shall take effect and be in force from and after its passage and due publication.

SPECIAL RULING

By

Department of Smoke Inspection and Abatement

(Approved by the Advisory Smoke Abatement Board of Engineers)

Section 5 of the Smoke Ordinance requires that proper provision for the purpose of securing complete combustion of the fuel to be used and for the purpose of preventing and abating smoke shall have been made before a permit is issued for the installation of any fuel burning plant for producing power and heat or either of them.

The Department of Smoke Inspection and Abatement will not approve or issue permits for the installation of low pressure heating boilers or hot water heaters of the surface burning type for burning coal, in sizes larger than those having a capacity to supply steam to 1200 square feet of direct steam radiation or its equivalent or to supply hot water to 2000 square feet of hot water radiation.

The surface burning type of coal burning furnace is defined as a hand fired furnace in which the fresh fuel is thrown directly on the hot fuel bed.

CHIMNEY SPECIFICATION

Homer R. Linn.

The walls of the chimney shall be of brick and shall be lined with approved fire clay flue lining. The joints of the flue lining shall be made air tight. The cleanout space at the bottom of the chimney shall be air tight when the cleanout door is closed. Flue lining shall start at least 4" below the bottom of the smokepipe intake and shall be continuous the entire height of the flue and project at least 4" above the chimney top to allow for a 2" wash and a 2" projection of the lining. The wash shall be formed of a rich cement mortar.

Chimneys shall not rest upon or be carried by wooden floors, beams, nor be hung from wooden rafters, but shall be built upon concrete or masonry foundations properly designed to carry the weight imposed without danger of settling or cracking.

Flues shall be . . in. x . . in. x . . ft. high (in no case shall the area of the flue be less than 12" x 12"), built vertical, without offsets and full size from the smokepipe inlet to the top of chimney.

The top of the chimney shall be at least 3 feet higher than the highest point of the building and in no case shall it be less than 30 feet above the boiler or furnace grates.

There shall be but one connection to the flue

to which the boiler or furnace smokepipe is connected. The boiler or furnace smokepipe shall be thoroughly grouted into the chimney and shall not project beyond the inner surface of the flue lining.

The chimney flue to which the heating boiler is connected shall be subjected to a smoke test by the mason contractor in the presence of the architect, or his representative, after the mortar has thoroughly hardened, and must be SMOKE TIGHT.

The method of conducting this test shall be as follows: With a good fire in the boiler or furnace, or in the base of the chimney, put about a square yard of tar paper on the fire. As soon as smoke appears at the top of the chimney, close the top of the flue with a piece of old carpet or wet newspapers held down by a weighted board. Keep the tar paper burning in the firepot for five minutes. The architect or his representative shall sign an acceptance in triplicate, stating that the chimney was tight under the above test, and shall give one copy to the mason contractor; one copy to the heating contractor and one copy to the owner.

All work done under this specification must be in accordance with the requirements of the National Board of Fire Underwriters.



Charm

of an open fireplace

THE uses of gas are nicely adjusted to essentials in the modern way of living. The beauty of fine homes is enhanced where gas is used for heating.

A semblance of live coals, but with the glowing heat supplied by gas, are features of this new fire-place heater which gives all the visible and sensible charm of an open fire without any of the disadvantages of dirt and ashes.



Architects and Builders Service



The Peoples Gas Light and Coke Company

HEATING BY GAS

By **FREDERICK W. HERENDEN.**

During the year 1929, there were over 100,000 central plant gas heating installations made in this country. This rapid growth in the use of gas for house heating is, in part, due to the development of the distribution of Natural Gas to our larger cities during the past year. Probably the most important factor in this growth has been the increased public acceptance of the use of gas for heating homes. Utility gas rate structure for house heating purposes, both Natural and Manufactured Gas, tend to make this use more desirable from the customer's standpoint.

Equipment Should Be Gas Designed.

The combustion characteristics of gas are such that it can be utilized most economically and satisfactorily in a heating device, be it a steam or hot water boiler, or a warm air furnace, when that device has been designed solely for the use of gas. Flame characteristics and freedom from fuel bed draft losses dictate design features that are not found in the device originally designed to burn solid fuel. These peculiar design features are incorporated in a number of well-known gas burning heating appliances, which differ in details of refinement, to a somewhat greater extent than in fundamental principles.

Appliances and Gas Heating Controls.

Gas burning heating devices designed solely for the utilization of gas as a fuel, are available for steam, hot water and warm air heating systems, in a size range extending from the small bungalow to the large office building. Small graduations between successive sizes in any given line of appliances, enable heating requirements to be met with a minimum amount of excess capacity being necessitated. Absolute certainty as to the performance and heat generating capacity of a gas burning appliance enables the choice of the proper type and size to be made with the highest degree of accuracy. Freedom from the effect of variable drafts, high winds, low barometric pressure make the selection of the proper size of gas burning appliance a problem that can be solved with scientific accuracy.

Construction of Boilers.

The usual heating boiler designed for gas fuel is sectional in construction, made of a number of parallel and substantially vertical cast iron sections. Different makers resort to different expedients to render the heating surfaces effective as possible. Some use a tubular design, others use extended surface in the form of lugs or ribs, some may incorporate both of these features or other features peculiar to their individual design. Horizontal burners of the atmospheric Bunsen type, usually with drilled ports in cast iron bottles are the general means of burning the gas. The burners are arranged directly beneath the sections. The entire assembly is almost invariably enclosed in a well-insulated sheet metal jacket, generally finished in a more or less attractive surface and color.

High Burner Efficiency.

Due to the absence of any draft loss, due to fuel bed, the gas passage can be designed to provide the high gas velocity essential to heat transmission, while at the same time, keeping the actual frictional effect to such a low figure that pressures within the combustion and flue spaces are practically atmospheric. The gas is delivered to the burners by the gas company at a definite and positive pressure, no mechanical devices such as mo-

tors or blowers are necessary for the delivery of the fuel and for its mixture with the air for combustion. The usual building heating appliance designed originally for the use of gas is free of moving parts or of the necessity of electric current to insure steady operation. Due to the fact that combustion and flue gas travel take place at practically atmospheric pressure, such an appliance will operate successfully on practically no draft. Devices to be placed in the flue connection for the purpose of reducing the pull of the chimney and to minimize the effect of variable atmospheric conditions, are standard parts of gas designed heating appliances. These are commonly called Down Draft Diverters. Due to the freedom of the effect from variable chimney draft, constant efficiencies of 80% or better can be maintained throughout the heating season.

Gas Boiler Controlling Devices.

Gas designed heating appliances are provided with controlling devices that insure continued automatic operation at a constant efficiency, free from possibility of accidental shut-down. They should always be operated under the primary control of a room thermostat. The quick response of the gas burning heating appliance's demand for heat, together with the small heat storage capacity, enables the temperature of the premises served by a well designed system to be held within a two degree range. Standard controlling devices on gas designed heating appliances include a gas pressure regulator that maintains a constant rate of fuel supply, steam pressure or water temperature limit control, low water cut-off devices on steam boilers and thermostatic pilots that prevent waste of unburned gas in the event of pilot outage.

All of these controlling devices may be absolutely independent of electrical current, so that in the event of current failure, the heating of the premises is uninterrupted.

Clock Controlled Thermostat.

Room temperature thermostats for application to heating systems served by gas burning appliances, may be secured, if desired with a clock that functions automatically to reduce the temperature of the premises to a pre-determined figure at a certain hour, and then bring it back up to the normal figure at another pre-determined time. These clock thermostats are obtainable either as an eight day clock or as an electric clock. The quick response of gas burning appliances enables this practice to be followed with quite satisfactory results. Extensive experiments indicate that a worth while fuel saving occurs as the result of maintaining a lower temperature during the night hours.

Construction of Gas Warm Air Furnaces.

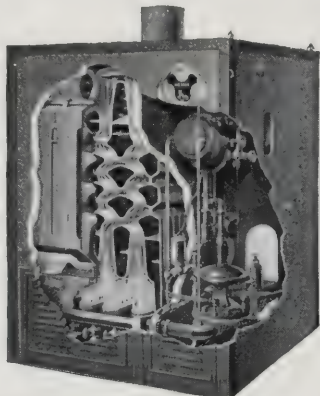
A number of gas warm air furnaces, designed exclusively for gas fuel are available. There is a greater variation in types of warm air furnaces than in steam and hot water boilers. Furnaces are made with cast iron heating surfaces, sheet metal surfaces or combinations of the two constructions. Straight upward flue travel is found in some, while others are constructed with reversible flues. In recent years, furnaces have appeared on the market, which are designed solely for forced air operation, secured with a fan.

Furnaces which are designed for gravity operation seem, however, to be capable of universal application and to give equally good operating results when used with a fan and an air distributing system laid out for fan operation.

Bryant Gas Heating

*covers the entire range of
Automatic Heating requirements*

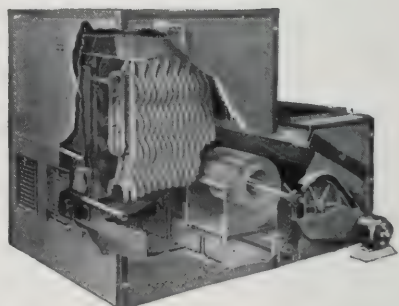
Whether it be for Steam, Hot Water, Vapor or Warm Air, in new homes or old, in bungalows or great office buildings, there is a type and size of Bryant Gas Heating plant especially fitted for the job.



Cutaway View Model 45
Bryant Boiler.

A "built-for-the-job" gas boiler, designed for use with either natural or manufactured gas. Tens of thousands of home owners, the country over, can attest the complete reliability of Bryant Gas Boilers.

The Bryant Forced Warm Air Furnace, for warm air heating systems can also be operated as a gravity system. Positive circulation of air is secured by blower type fan. Circulated air is cleaned and humidified.



Cutaway View Bryant Forced Warm
Air Furnace.

BRYANT
GAS
HEATING



*For complete data on sizes, ratings, etc.,
See Sweet's Catalogue, or write*

The BRYANT HEATER & MFG. COMPANY

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Cleanliness, automatic control, quick response and possibility of artificial humidification render a warm air system, served by a gas burning furnace, the type of heating plant suitable for installation in the highest class of residence.

Warm Air Furnaces are capable of control by room thermostats and in addition are provided with gas pressure regulators, air temperature limiting devices and thermostatic pilots.

Ratings and Selections.

In sharp distinction with most fuel burning devices a gas burning heating appliance can be operated at a fixed pre-determined rate of fuel input, with no possibility of a variation in excess of plus or minus 2%. It will, under those conditions, deliver a known and fixed quantity of heat available for distribution to the system. A fuel furnished by a gas company may be expected to be constant in heat value. The rate at which it is fed into the appliance is maintained constant by a gas pressure regulator. The heat transfer efficiency of the appliance is unaffected by atmospheric condition, neither is there any possibility of soot accumulation on heating surfaces to interfere with heat transmission. Thus, one uncertainty in the selection of boiler or furnace size is eliminated. The appliance output is the most certain factor in the entire system.

Scientific Rating.

Appliance ratings are determined by a laboratory test which establishes the amount of heat available for delivery to the heating system. In the case of steam or water boilers, the ratings in square feet of radiation are secured by dividing the hourly B.T.U. output by 240 and 150 respectively. These ratings are a true measure of the heat delivery capacity of the boiler. The selection factors given on page 565 (in the 1928 edition) are applicable to boilers rated in such a manner when they are to be applied to heating systems consisting exclusively of direct radiation. When a heating system includes other varieties of radiation, such as blast coils or unit heaters, the selection of boiler size must be based on engineering consideration, rather than on an inflexible rule.

Furnace ratings are generally expressed in terms of the hourly B.T.U. available at the bonnet, since in a gravity system from 15 to 20% of the heat at the bonnet is lost on its way to the register, the furnace rating required can be safely determined by dividing the calculated hourly heat loss from the premises by 0.80. In the case of a fan system, the transmission line can be made slightly smaller and the dividing factor can be correspondingly increased.

INSTALLATION

Aside from its connection to the heating system, in which a gas appliance does not in the least differ from any other fuel burning appliance, the following points are to be considered in the installation of a gas burning heating device.

(a) Gas Supply.

Obviously, the pipe carrying the gas from the meter to the appliance must be large enough to deliver the required amount of fuel at the prevailing pressures. The valve and connections that are sold as part of the appliance are proportioned to carry the required gas at the lowest supply pressure that can be reasonably expected to exist. That is a responsibility of the appliance manufacturer. If the line running from the water to the appliance is one pipe-size larger than the gas control valve, it will have adequate capacity.

(b) Air Supply for Combustion.

Gas, like any other fuel, requires air for its combustion. The air necessary to sustain combustion and to maintain adequate boiler room ventilation amounts to at least 7.5 cu. ft. for each cubic foot of 500 to 550 B.T.U. Gas. Failure to provide for the entrance of sufficient air into the boiler room, to meet this requirement, may result in symptoms that may be mistaken for those of insufficient draft. The effect of insufficient air is more evident to the eye, with gas as fuel, than with solid or liquid fuel, but it is no more destructive to efficiency of combustion.

(c) Venting Flues.

Although a gas designed appliance operates with practically atmospheric pressure, within its combustion and flue spaces, it, nevertheless needs adequate provision preventing the products of combustion. Poor chimney conditions are prolific causes of condensation, of water vapors within chimneys and chimney connections as well as of poor combustion due to radiated air within the boiler room. Although the products of combustion issuing from an appliance designed for gas burning and under normal conditions, such as a standard make of gas boiler or gas furnace, are totally harmless to life, still every effort should be made to insure their adequate venting from the premises through a suitable effective chimney.

(d) Small Fire Hazard.

When a heating appliance designed for gas burning is installed, no particular precautions in the direction of fire prevention are necessary. Standard makes of appliances are thoroughly insulated and give off very little heat to surrounding objects. In most appliances, all of the electrical wiring involved can be low voltage. There is no fuel storage required nor any chimney temperatures of any high degree.

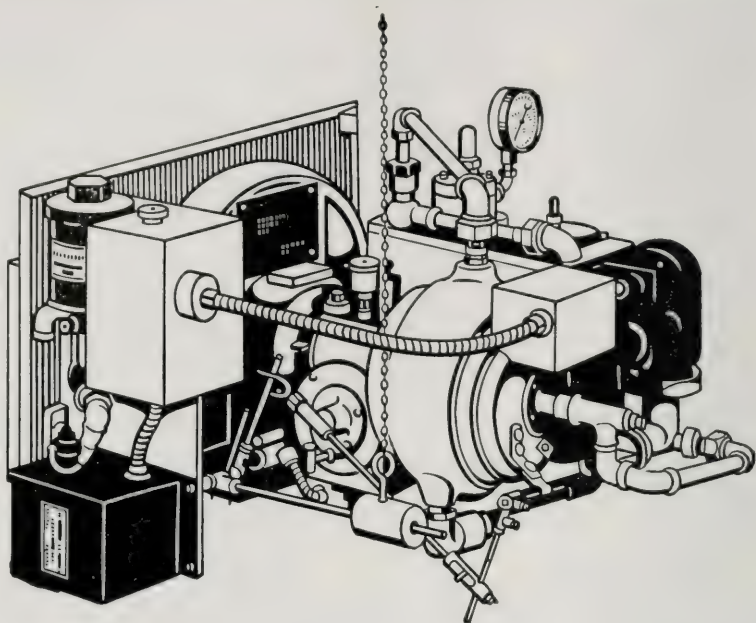
Operating Costs.

In evaluating the cost of heating given space, the following are among the items that should be given consideration.

- (a) Initial investment for apparatus.
- (b) Value of the space occupied by the apparatus.
- (c) Rate of depreciation of the apparatus.
- (d) Cost of attendance, including ash-handling.
- (e) Reliability in operation, possibility of service being required and cost of that service.
- (f) Space required for fuel and ash storage and its value.
- (g) Inconvenience and damage from dust and soot.

Without going into the calculations of a concrete example, let it be said that proper calculation of comparative heating cost, including the factors mentioned above, will often reveal gas to be actually cheaper than other fuels selling at a less sum per million B.T.U.

In large installations, the amount of gas required per square foot of radiation per season, depends to a great extent upon the characteristics and uses of the building to be heated. Each case should be properly figured out on its own merits by an engineer familiar with gas application. Smaller installations, such as residences can be estimated with reasonable accuracy by the use of simple factors based on past experience. In the neighborhood of Chicago, it can be safely assumed that the average residence will require 1140 cu. ft. of gas per season, per square foot of steam radiation, or 660 cu. ft. per season, per square foot of water radiation.



250 hp *Automatic* Oil Burner

Listed as Standard by Underwriters Laboratory
 2500 installations in Metropolitan Chicago
 Burns No. 5 oil without pre-heating
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OIL HEATING

By **HARRY F. TAPP**, Technologist
American Oil Burner Association, Inc.

Because of the large number of reliable oil burners that are on the market, there is considerable confusion as to the relative merits of these burners. Certainly it is important to look into the construction of the burner as to design, workmanship and materials, but a point that should be kept in mind, is that you are buying not only a burner but an installation. The ability of the man making the installation and adjusting the burner to meet the needs of each application, should receive careful consideration when making a choice of oil heating equipment.

Burner Types and Characteristics.

There are two distinct types of oil burners used for oil heating—the natural draft burner and the mechanical draft burner. Their names indicate the manner in which the air for combustion is obtained.

The natural draft burner requires no motor and usually has no moving parts. The air for combustion is supplied by the pull of the draft and is therefore dependent upon the design of the chimney. This type of burner is often incorrectly referred to as a gravity type burner. Gravity indicates the manner in which the fuel is fed to the burner and a gravity system is applicable to either the natural draft or the mechanical draft burner.

The mechanical draft burner is motor driven and the air for combustion is supplied by a fan or blower. Generally where a fan is used it is of sufficient capacity to supply the entire amount of air for combustion when the burner is operating at the maximum rate. Where a blower, either centrifugal or positive pressure, is used, only a portion of the air required is supplied under pressure, the remainder being induced by the injector action of the air from the blower, plus the pull of the natural draft from the chimney. The air from the blower is generally used to aid in the atomization of the fuel.

The natural draft burner is more sensitive than the mechanical draft burner to changes in the weather, wind currents about the chimney and other factors which cause a variation in the draft intensity. A well designed chimney and the use of a special draft regulator will, to some extent, overcome this condition.

The mechanical draft burner, equipped with a blower, produces a more constant supply of air under varying draft conditions and, therefore, maintains a uniform, efficient combustion condition.

The second classification of burners is usually made with reference to the means employed to prepare the fuel for combustion. The distinguishing terms are "atomizing" and "vaporizing."

In the vaporizing burner the fuel is prepared for combustion by the addition of heat. The heat serves to convert the liquid fuel into a vapor which is mixed with the air for combustion either just before or during the combustion process. Vaporizing burners require a light fuel and there is always the possibility of carbon trouble due to cracking or decomposition of the oil in the vaporizing chamber.

In the atomizing burner the fuel is broken into a fine mist of small particles which are mixed with the air for combustion either just before or at the time they are forced into the combustion chamber. The particles are so fine that they are quickly vaporized by the heat of combustion and, if properly mixed with the air for combustion, burn with a clean hot flame.

There are many ways to atomize oil—under pressure through a small orifice, by com-

pressed air or steam, by centrifugal force from the edge of a rapidly rotating cup or disc and numerous other methods equally efficient. All the methods will adequately atomize the oil, and when applied with intelligence will give satisfactory results.

Atomizing burners successfully utilize slightly cheaper oils. They will start readily and can be economically used in large installations.

Ignition Systems.

In most natural draft burners the oil is ignited manually with a torch through the firing door, although some of them are provided with a gas pilot. Full automatic burners are ignited with either an electric spark from a spark transformer or from a gas pilot light. This gas pilot in some designs burns constantly, while in others a combination of the electric and the gas system is used, the spark igniting the gas and the gas flame igniting the oil.

The type of ignition system that is used is dependent, to some extent, upon the design of the burner and upon the personal opinion of the designer. Several burners are being designed to make the means for ignition optional with the purchases. Where gas is used, the application of the burner may be limited to a territory having a gas supply, although it can be used with gas supplied in containers. Under average conditions the cost of ignition with gas is slightly greater than with electricity.

Automatic Burner Controls.

A room thermostat is used to indicate and control the operation of the burner and maintain the desired temperature between a limiting plus or minus one degree.

The boiler or furnace is provided with a control to prevent overheating and, in the case of steam boilers, to prevent the development of abnormal pressures.

A safety control is provided to establish a time limit within which the oil must be ignited every time the burner is started and shut the burner down in the event ignition does not take place.

There are two systems of control instruments. The low voltage (15-20 volts) and the high voltage which is the voltage at which the motor operates, usually 110 volts. Both systems have been used with complete satisfaction and opinion as to which system is the best is evenly divided.

In order to obtain the best results from the thermostat it should be located with care. Most people prefer to have it in the living room. It should be located on an inside wall, about five feet from the floor at the breathing level, protected from abnormal drafts such as stairways or entrances. It should not be near the chimney, radiators or registers, hot water pipes or steam pipes, or other sources of heat. Avoid concealed hot water or steam pipes.

In designing new homes, the location of the thermostat can be provided and a panel, in keeping with the general scheme of decoration, designed for its mounting. The mounting panel can be provided with an electric conduit to carry the control wires from the basement.

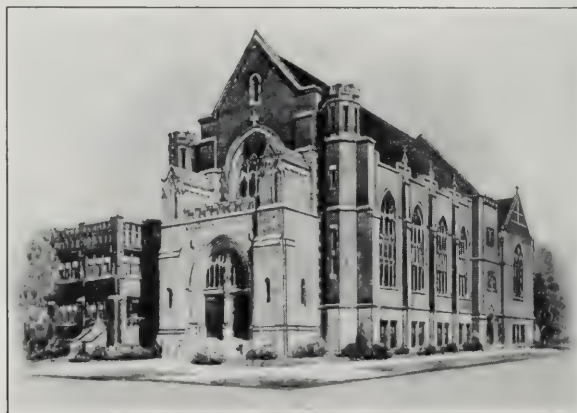
To make the operation of the thermostat effective, it is necessary that the radiation installed in each room be carefully proportioned. This establishes the desired temperature in each room when the room in which the thermostat is located is at the correct temperature.

LAMMERT



OIL BURNERS

The thought and energy of Lammerts' Engineers are directed toward very definite goals which they have reached very successfully. The whole effort is to produce equipment and installations of extremely long life and low maintenance, combined with highest operating efficiencies. This is true economy as well as correct engineering. That is why Lammert Oil Burning Installations help build good will between the architects and their clients.



A sound, reliable Chicago organization with its factory and engineering force right in Chicago, Backed by forty years of power plant experience with the largest power plants in this territory. Built and installed to maintain a reputation which is already of sterling value. Our engineers are glad to be of service to you. Call for them.



Home, Apartment, Hotel, Institution or Factory



LAMMERT AND MANN CO.

221 N. Wood Street

CHICAGO, ILLINOIS

Established 1892

The majority of the burners operate on the intermittent principle, but there are a few that operate on a graduated control system and the flame intensity is varied to meet the temperature variation as indicated by the thermostat. There is considerable discussion among designing engineers as to the relative merits of the two systems, but while the continuously operating burner may have a slight advantage during colder weather, the intermittent would be more economical during the mild weather, so that over the entire heating season the total amount of fuel used will be very nearly the same.

Any good boiler can be used satisfactorily with oil burning equipment but, naturally, a boiler that has been specially designed for oil will have the advantage. In selecting a boiler for use with an oil burner, make sure that it has long flue passes and that the combustion gases are not short circuited from the combustion chamber to the stack outlet.

In applying oil burning equipment to existing coal burning boilers it is sometimes advisable to baffle the passes to increase the travel of the hot flue gases and keep them in closer contact with the heating surface. In fire-tube boilers retarders are used in place of baffles. These retarders inserted in the tubes give the flue gases a spiral motion and keep them in contact with the surface of the tubes, increasing the heat transfer in this way.

An automatic feedwater regulator should be included for hot water or steam installations as the boiler is often neglected. The automatic features eliminate the necessity of daily inspections of the boiler room.

Welded steel warm air furnaces are generally more suitable, although satisfactory installations are made in cast iron furnaces when all joints have been sealed to prevent leakage of combustion gases. It is recommended that an inspection of the furnace be made at the beginning of each heating season.

Domestic Hot Water Supply.

Any automatic burner may be used in connection with steam, vapor, or hot water heating system for furnishing hot water for household use both summer and winter by means of an indirect heater on the boiler. A temperature control set at 180 degrees Fahrenheit maintains the temperature of the water in the boiler at all times and insures an ample heat transfer to the hot water tank through the indirect heater coil.

In hot water boilers an automatically operated valve is placed in each one of the risers. The actuating mechanism of the valve is electrically connected to the room thermostat and only opens the valve when the thermostat calls for heat. There are also indirect heaters having an automatically operated valve which controls both the water flow to the radiators and the supply of domestic hot water.

Some of the distinct advantages to an arrangement of this kind are:

1. Year round operation keeps the burner and boiler in good condition.
2. Only one central heating plant is necessary, conserving space and increasing the efficiency of the boiler.
3. Uniformly hot water is available at all hours.

For warm air systems—or when desired—separate automatic oil burning hot water heaters with attractive insulated jackets are used.

Actual results have shown that the total operating cost for the service rendered with either indirect heaters or separate oil burning units is lower than that of any other type of automatic water heating equipment.

INSTALLATION

Installations should always be made by men trained under the direction of the burner manufacturer, as every burner has peculiarities that should be given consideration when

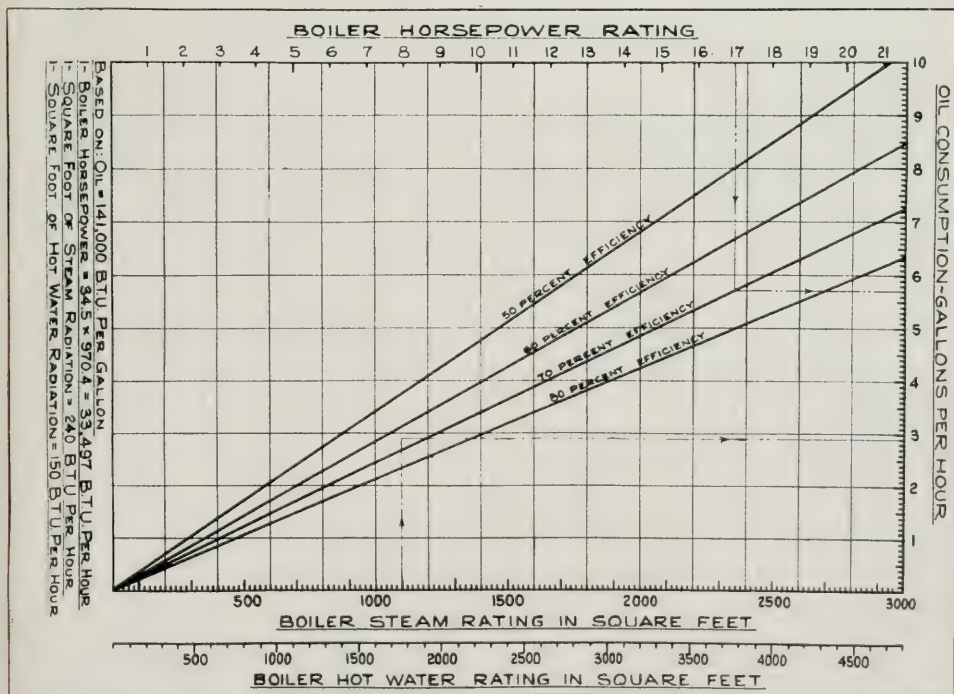


Fig. 1.

STEARNS INCINERATORS

Surface Burning — Draft Controlled

Built-In Types
Cast Iron Portables
Wall Types

Garbage and Waste Destructors

Special Hospital Equipment

"The INCINERITE"

A National Product for 20 Years

The Stearns Incinerite, manufactured since 1910 and recognized as a superior product, scientifically constructed, continues its leadership in the incineration field with the new improved design of the
SURFACE BURNING DRAFT CONTROLLED UNIT

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Factory: Stearns Incinerator Inc., Syracuse, N. Y.

the installation is made. It is also important that the burner be correctly adjusted for each installation as greater losses in efficiency can result from poor adjustment than from poor design. A burner should have sufficient capacity to develop full rating of the boiler and it is preferable that it have some excess; it should also be adjustable over a range from 50 to 100 per cent rating. See Figure 1. The flame adjustment is best determined by a flue gas analysis, but a good check can be made by noting the color of the flame. A white flame indicates excess air or insufficient oil, a red smoky flame indicates insufficient air or excess oil, and an orange flame just tipped with red indicates an efficient and clean combustion.

The boiler room should be well ventilated so that the burner can obtain an adequate supply of fresh air at all times.

Chimney Design.

Although slightly less draft is required for oil heating equipment and a smaller flue area will suffice, it is recommended that the chimney be designed to meet the boiler manufacturers' specifications. The oil burner should have a separate flue to provide a uniform draft and to prevent any mechanical sound from being amplified and transmitted to the rooms of the house. A well designed chimney is as important for an oil burner as it is for a coal fired heating plant.

Fuel Oil Specifications.

In April, 1928, the American Oil Burner Association adopted uniform fuel oil specifications as recommended by the Association Committee on Fuel Oil Specifications. On January 9, 1929, a joint conference of representative refiners, distributors, and consumers of fuel oil, manufacturers of oil burners, and general interests, adopted these specifications as commercial standard for domestic and industrial fuel oils, and they have since been accepted by the Department of Commerce and the entire industry.

These specifications make no reference to the gravity of an oil, a quality that has been widely used in the past as an index of volatility. Gravity is not a reliable indicator of the quality of a fuel oil and so has no place in the specifications.

All listings of burners published by the Underwriters' Laboratories give the minimum grade number of oil suitable for each burner.

Detailed Commercial Standard Specifications, publication CS12-29, may be secured from the United States Government Printing Office, Washington, D. C. Below is a summary of the specifications.

Grade of oil	Flash point		Water and sediment maximum	Pour ¹ point, maximum	Distillation test			Viscosity, maximum
	Minimum	Maximum			10 per cent point, maximum	End point, maximum	90 per cent point, maximum	
No. 1 Fuel Oil	110° F. or legal	165° F.	Per cent 0.05	15° F.	420° F.	600° F.		
No. 2 Fuel Oil	125° F. or legal	190° F.	.05	15° F.	440° F.	...	620° F.	
No. 3 Fuel Oil	150° F. or legal	200° F.	.1	15° F.	460° F.	.....	675° F.	{ Saybolt universal at 100° F. 55 seconds

¹ Lower or higher pour points may be specified whenever required by conditions of storage and use. However, these specifications shall not require a pour point less than 10° F. under any conditions.

Grade of Oil	Flash point		Water and Sediment, maximum	Pour point, maximum	Viscosity, maximum
	Minimum	Maximum			
No. 4 Fuel Oil	150° F.	(¹)	Per cent 1.0	(²)	{ Saybolt universal at 100° F. 125 seconds.
No. 5 Fuel Oil	150° F.	.....	1.0		{ Saybolt Furol at 122° F. 100 seconds.
			Water	Sediment	
No. 6 Fuel Oil.....	150° F.	.....	(³)	0.25	{ Saybolt Furol at 122° F. 300 seconds.

¹ Whenever required, as, for example, in burners with automatic ignition, a maximum flash point may be specified. However, these specifications shall not require a flash point less than 250° F. under any conditions.

² Pour point may be specified whenever required by conditions of storage and use. However, these specifications shall not require a pour point less than 15° F. under any conditions.

³ The total water plus sediment shall not exceed 2.0 per cent.

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The following table gives the approximate gravity range for the various grades, together with the approximate heat content:

Oil No.	Approximate Gravity Range—A. P. I.	Approximate B.T.U. per gallon
1	36°-40°	136,000
2	32°-36°	138,000
3	28°-32° and 25°	141,000
4	24° plus	144,500
5	18° plus	146,000
6	14° plus	150,000

Comparative Costs

Comparative cost figures for various fuels depend entirely upon the heat content of each fuel and the efficiency with which each is utilized. With oil it is reasonable to assume an increase in efficiency of 10 to 15 per cent over coal. Charts shown in Figures 3 and 4 give comparative consumption of oil against seasonal coal or gas requirements. These figures are based on an oil containing 141,000 B.t.u. per gallon. By referring to Figure 2, these figures can be corrected for other grades of oil.

the absence of these, the regulations of the National Board of Fire Underwriters should be followed. Copies of these regulations may be obtained from the Underwriters' Laboratories, 207 East Ohio Street, Chicago, Illinois. These latter regulations permit the oil to be fed by gravity from an exposed 275 gallon inside storage tank. In many localities it is permissible to install two exposed 275 gallon tanks with a three-way valve. This three-way valve permits gravity feed from either tank and insures an adequate fuel supply without a buried tank. This type of installation has many advantages and is rapidly coming into favor with local authorities having jurisdiction over the installation of oil heating equipment.

A very desirable installation for larger homes is an outside buried tank of at least 1100 gallons capacity. Where it is impractical to locate this tank below the level of the burner, it is necessary to use some means to prevent the siphoning of oil from the tank in case of a break in the fuel supply line. There are several devices for this purpose approved by the Underwriters' Laboratories. The use of a large buried tank eliminates the necessity of constantly watching the fuel supply and in some cases, will permit the

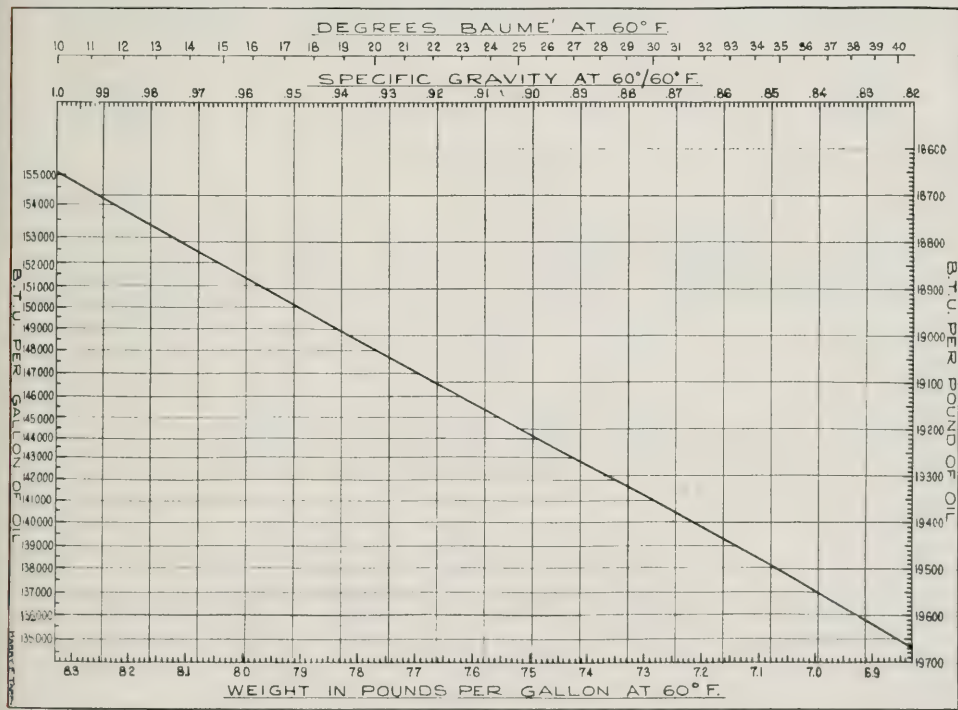


Fig. 2.

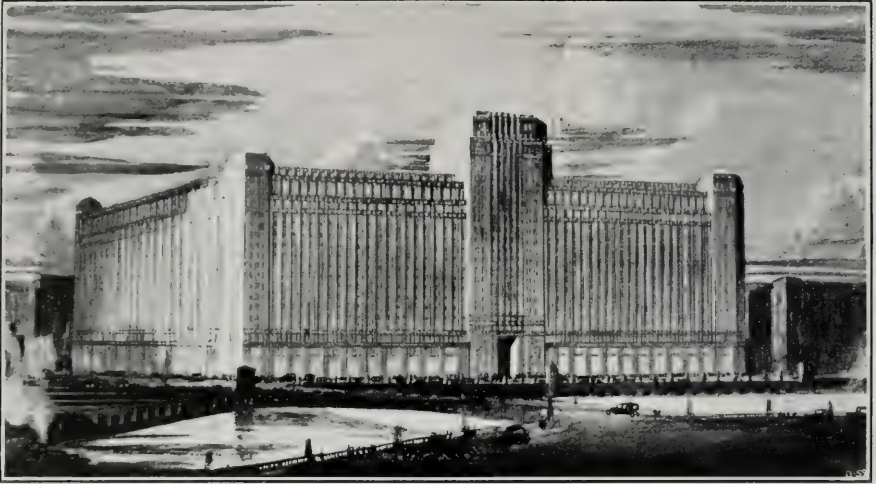
When larger installations are made, such as in apartment houses and office buildings, the saving in labor, effected by the use of oil, will offset considerable increase in the cost of the oil over the cost of the coal. This saving in labor permits oil heating equipment to be installed, with its advantages of storage, handling and cleanliness, and operated at an equal cost with the coal fired installation, even though the actual cost of the oil may be more than the cost of the coal.

Tank Installations.

Tank installations should always be made in accordance with local regulations, or in

purchase of fuel at a price, enough lower, to pay for the difference in installation cost. All tanks should be provided with a direct reading gauge to give a constant check on the amount of fuel on hand. All tanks must be vented and they should be located so that the fill line terminal is near the drive, or curb, to facilitate delivery from the tank truck.

The vent line from the tank is usually located as inconspicuously as possible on the side of the building. In constructing a new home, it is possible to provide a channel or duct in the wall of the building so that the



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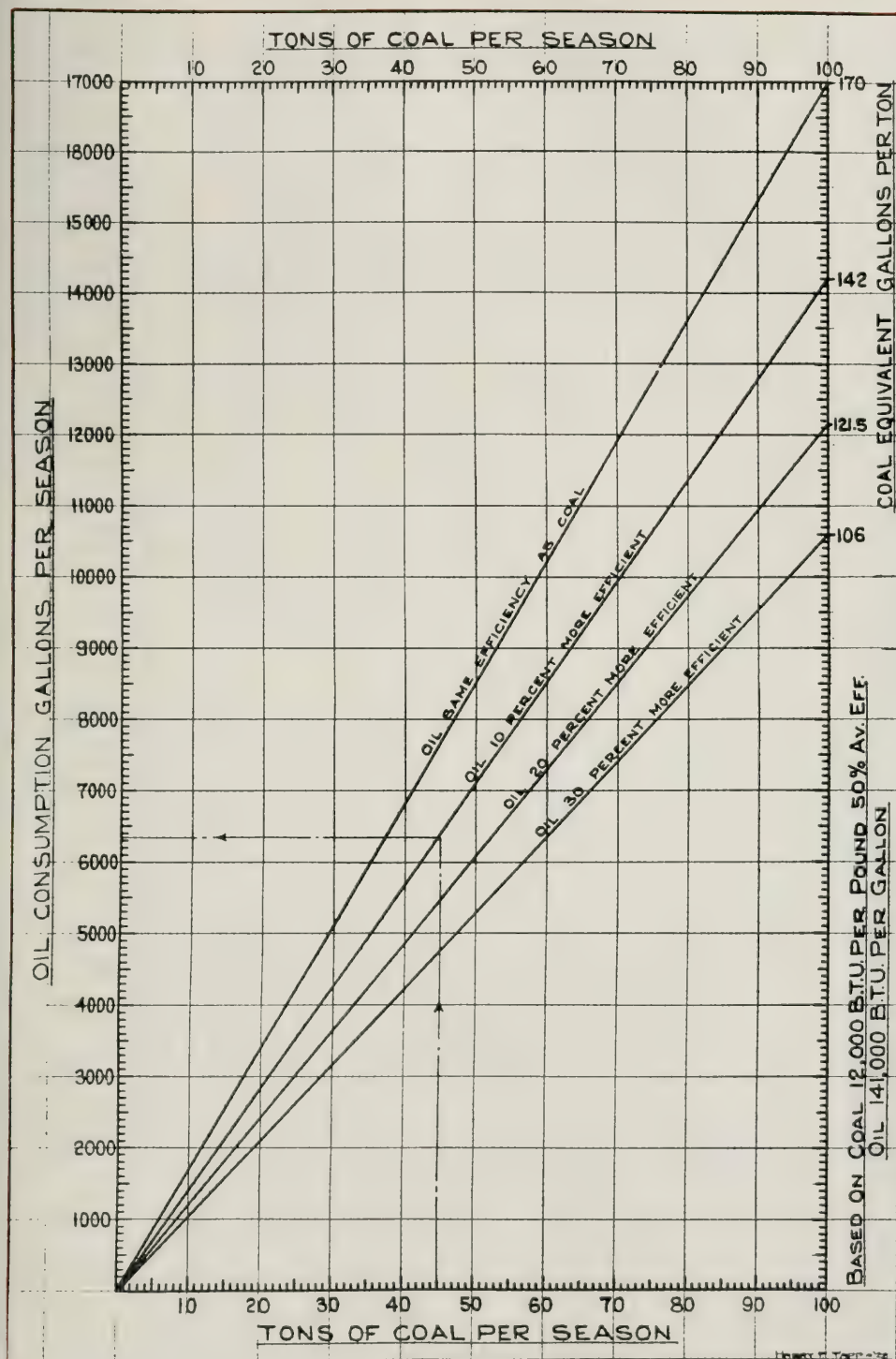


Fig. 3.

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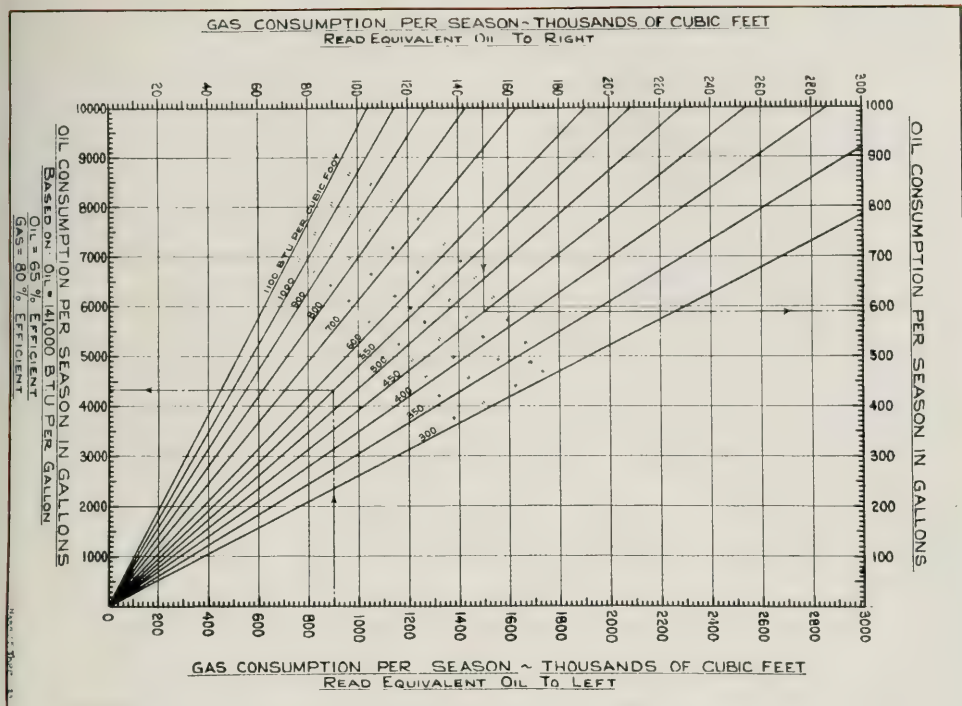


Fig. 4.

only exposed part is the vent cap where the line terminates.

The tank location should be near the drive or curb so that the oil can be delivered through a hose from the delivery truck tank.

Important Considerations in Selecting Oil Burning Equipment.

In specifying an oil burner the highest degree of satisfaction is experienced when the following points are carefully considered:

1. Consider only equipment listed as standard by the Underwriters' Laboratories and manufactured by nationally known responsible concerns.
2. Consider only financially sound and mechanically competent dealers located within a reasonable distance from the installation, who will install the equipment in accordance with all local and State regulations, as well as in accordance with manufacturer's specifications.
3. Insist that your heating system be carefully checked by the dealer before the installation is made.

Architects' Counsel To Clients.

A proper appreciation by the home and building owner of the nature of his oil heating equipment, its capabilities and limitations, and the care it will require, will do more than anything else to assure satisfying results. The essential points for the client are summarized here:

1. Oil heating equipment functions only to provide heat. It will not take care of the water level in the boiler. It will not operate when the current is shut off, nor when the fuel is exhausted. The entire plant should have regular inspection to see that these conditions are correct.

tion to see that these conditions are correct.

2. Oil burners require reasonable care—oiling of moving parts and occasional cleaning. In this respect they are like clocks, automobiles, fans and electric refrigerators.
3. Oil burners are subject to adjustment like all other machines, and they operate best when perfectly adjusted. Expert service men can make the occasional adjustments far better than a layman or ordinary mechanic.
4. Once the correct adjustments are made, they can be disturbed only by the following methods:
 - (a) Manually, as when someone attempts to interfere with the automatic operation of the burner or to adjust the parts. Do not disturb the apparatus except for regular inspection, oiling and cleaning.
 - (b) By changes in fuel. Stick to the same grade and quality of fuel, or have a service man readjust the burner when changes are necessary.
 - (c) By pressure of foreign matter—particularly in the fuel.
 - (d) By natural wear. Periodic inspections will take care of these changes.
5. Automatic operation does not permit neglect. Give to your heating apparatus the reasonable care and attention any mechanical equipment requires.

These reasonable suggestions, if followed, will assure the maximum benefits and lowest operating costs to the owner.

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These suggestions are nearly all given from the view-point of domestic and small commercial building installations because this is the most active field at the present time. If further information concerning special problems of oil heating installations is desired, it may be obtained by writing to the American Oil Burner Association, 342 Madison Avenue, New York, N. Y.

Outline of Architect's Specifications.

Covering the Installation of Oil Heating Equipment.

Scope of Contract.

These specifications cover the complete installation of an oil heating apparatus and fuel oil storage system, for the boiler installed in The apparatus shall consist of a oil burner, fuel oil storage tank (tanks); room thermostat, boiler control, burner safety device, necessary and adequate installation of refractory lining in the combustion chamber of the boiler; all necessary piping, valves, electric wiring, switches, etc., all tested and ready for operation.

The oil heating installation shall comply with all local ordinances (or rules of National Board of Fire Underwriters), and must meet available electric current facilities.

Liability.

The contractor shall assume, etc., etc.

Completion of Work and Payment.

The work is to be completed, etc.

Materials.

All materials, etc. (recommended furnished by contractor.)

Cutting and Patching.

The contractor shall do all, etc.

Cleaning up.

The contractor shall promptly, etc.

Additional Data.

All visible piping and scratched places will be painted to match other new similar adjacent material.

Oil Burning Apparatus.

The contractor shall furnish, make all necessary changes in the boiler (or furnace) and install, one completely equipped..... oil burner, etc.

Fuel Oil Storage.

The contractor shall furnish and install (one gallon inside) fuel oil storage tank. Tank shall be manufactured, tested and installed in accordance with local regulations (or rules of National Board of Fire Underwriters).

Piping.

Piping shall be installed in accordance with local regulations (or rules of National Board of Fire Underwriters).

Wiring.

All wiring shall be done in accordance with the National Electric Code, and local regulations.

Thermostat Control.

The thermostat shall be installed in room, five feet from floor, removed as far as is practical from any and all warming influences such as radiators, hot water pipes, etc., or possible cooling drafts.

Warm Air Furnace Control.

Furnaces shall be equipped with thermostatic warm air jacket control, wired in connection with room thermostat.

Boiler Control.

A maximum pressure or temperature control shall be installed in the boiler according to manufacturer's printed instructions. This control shall be wired so as to automatically prevent creation of excessive pressure or temperature in the boiler.

Burner Safety Device.

A burner safety device shall be installed in connection with the burner, so designed as to make the burner inoperative if for any reason the burner does not function properly.

In General.

The omission from these specifications of any minor detail of construction, installation, material, specialties, etc., shall not relieve the contractor from furnishing same in place complete, and such omissions shall not entitle contractor to make claims or demands for extra materials or labor. However, in the event that unusual water is struck or if quicksand, rock or other unusual obstructions are encountered, the contractor shall proceed with the necessary special construction that is involved for which the contractor will receive sum equal to the actual cost of such special work plus per cent. The word "cost" as hereinabove used shall be understood to consist of actual field cost and overhead.

Adjustment.

The contractor shall agree to provide free inspection and adjustment of the oil burner installation for the first ninety days of the heating season during which the installation is made. The heating season shall be considered as beginning September first for installation made during the summer.

Guarantee.

The contractor shall guarantee to make good by replacement or repair, any original defects in parts, material or workmanship previously specified or described; provided that this obligation is assumed only in the event that written notification of such alleged defect be given the contractor within a period of one year after said equipment has been installed.

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Pure Oil Building

SECTIONS OF THE SANITARY CODE OF INTEREST TO ARCHITECTS, WITH INDEX

Sections of the Building Ordinance pertaining to Sanitary and Health Departments are not included in these sections and may be found by referring to the Index to the Building Ordinance.

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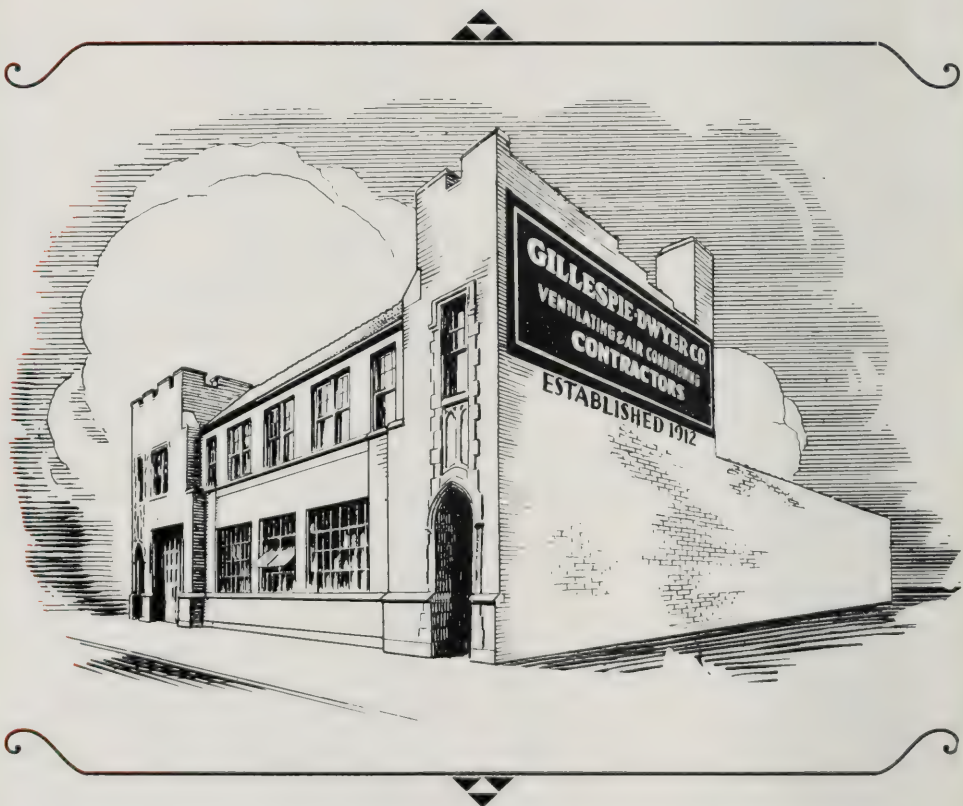
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BAKERIES AND BREAD.

295.—Bakery defined.] Any establishment, place, wagon or stand used for the manufacture of bread, buns, rolls, biscuits, cakes, crackers, matzos, pretzels, pastry, doughnuts, waffles, noodles, macaroni, spaghetti or ice cream cones, or any establishment used for the process of mixing, compounding or baking of any food product of which flour or meal is a principal ingredient, for sale to the public, or for the purpose of a restaurant, bakery, hotel, commissary or catering establishment, shall be deemed a bakery for the purpose of this article; provided, that a licensed restaurant in which any of the foregoing food products are mixed and baked for consumption in such restaurant only, or in ordinary restaurant kitchen stoves or ranges, shall not be considered a bakery.

300. Sanitary requirements—ventilation.] Every place used as a bakery shall be kept in a clean and sanitary condition as to its floors, side walls, ceilings, woodwork, fixtures, furniture tools, machinery and utensils. All parts of the bakery shall be adequately lighted at all times and shall be ventilated by means of windows or skylights or air shafts or air ducts or mechanical apparatus, if necessary, so as to insure a free circulation of fresh air all times. Such ventilating construction and equipment shall be of such character that a complete change of air in all parts of the bakery may be made at least four times each hour; provided, however, that it shall not be necessary to ventilate at such time or in such manner that the process of mixing or rising of dough shall of necessity be interfered with or prevented.

301. Floor—how constructed.] The floor of every place used as a bakery, if below the street level, shall be constructed of concrete, cement, asphalt or other impervious material, or of tile laid in cement, which floor may, if desired, be covered with a hardwood floor having tight joints; if above the street level, the floor may be of hardwood with tight joints or may be of any impervious material, as above provided. The angles where the floor and wall join shall be made and maintained so as to be rat-proof.

303. Walls and ceilings—woodwork.] The side walls and ceilings shall be well and smoothly plastered, tiled or sheathed with metal or wood sheathing, and shall be kept in good repair. If made of mill construction with smooth surfaces, such walls and ceilings need not be sheathed or plastered. All walls and ceilings shall be kept well painted with oil paint, or lime washed and calcimined, and all woodwork shall be kept well painted with oil paint.

304. Plumbing and drainage facilities.—water closets and sinks.] Every such bakery shall be provided with adequate plumbing and drainage facilities, including well ventilated water closets and impermeable wash sinks on iron supports.

Amended January 2, 1924.

305. Sleeping facilities—domestic animals, except cats, prohibited.] No person shall sleep in any bakery, or in the rooms where flour or meal used in connection therewith, or the food products made therein, are handled or stored. If any sleeping places are located on the same floor as the bakery, they shall be well ventilated, dry and sanitary. No domestic animals, except cats, shall be permitted in a bakery or place where flour or meal is stored in connection therewith, and suitable provision shall be made to prevent nuisances from the presence of cats.

309. Storage of materials and food.] All rooms for the storage of flour or meal for use in connection with any bakery shall be dry and well ventilated, and every bakery and room used for the storage of materials and food products in connection therewith

shall be so arranged that the shelves, cupboards, trays, troughs, bins, cases and all other appliances for handling and storing same can be easily removed and cleaned. If the floor of any such bakery or room is below the adjacent street level, no such materials or products shall be stored nearer to such floor than one foot.

311. New bakeries — requirements.] No new bakery shall be hereafter established in any room, basement or cellar in which the clear height between the finished floor and ceiling is less than eight feet six inches or in any room or place, the floor of which is more than five feet below the street, sidewalk or alley level adjacent to the building, or in any room or place which is not so naturally lighted by means of windows, doors or skylights that on clear days a book or paper printed with long primer type can be read between the hours of ten o'clock a. m. and two o'clock p. m. in all parts of the bakery which are used in mixing or handling bakery products; provided, however, that where a bakery is to be installed for the purposes of a restaurant operated in connection with a railway passenger terminal, in case the plans for such bakery shall in all other respects comply with the ordinances of the City and such special requirements as the Commissioner of Health shall deem necessary with respect to its sanitary features and shall be approved by said commissioner, the said provisions shall not apply.

If any new bakery hereafter established has its floor above, at, or not more than three feet below the adjacent street or alley level, no window opening by which it is ventilated shall be less than three feet above such street or alley level; if the floor of any such bakery is more than three feet below the adjacent street or alley level, no such window opening shall be less than eighteen inches above such street or alley level.

Amended January 2, 1924.

312. Bakery discontinued for six months and reopened—how considered.] If any bakery which is now being maintained and operated shall be vacated, discontinued or unused for a period of more than six consecutive months and shall thereafter be reopened and re-established as a bakery, such bakery shall be considered a new bakery for purposes of this chapter.

DRAINS, SEWERS AND GRADES.

1085. Work on tile drains inside building line—outside building line—by whom approved and supervised.] All work done by licensed drain layers on drains or pipes inside any building or structure, and all work done on any catch basin or cesspool located on or in any private premises, shall be done according to plans approved by the commissioner of health, and under the supervision and to the satisfaction and approval of the commissioner of public works; and no such work shall be done except on a permit in writing issued by said commissioner of public works.

All work done by licensed drain layers on drains or pipes outside any building or structure or upon any street, alley, or public way, shall be done under the supervision and to the satisfaction and approval of the commissioner of public works; and no such work shall be done except on a permit in writing issued by said commissioner.

1086. Inspection of work.] All work done by licensed drain layers, other than work done on local improvements paid for wholly or in part by special assessment while such work is under the supervision and control of the board of local improvements, shall be subject to the inspection, supervision and approval of the commissioner of public works; and any faulty or defective work done by any licensed drain layer which may at

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any time be discovered by him shall be made satisfactory to said commissioner.

Any licensed drain layer who shall neglect, refuse or fail to make good any defects or faults in his work which shall be discovered by said commissioner, shall not be permitted to do any further or additional work as a drain layer until the defects or faults so discovered have been made good in a manner satisfactory to the commissioner of public works; and any licensed drain layer who shall refuse, neglect or fail to make good such defects or faults, when requested so to do by said commissioner, or who shall otherwise violate or fail to comply with any of the provisions of this article or any rule or regulation of the department of public works governing or regulating the business of drain laying, shall have his license revoked by the mayor upon the recommendation of said commissioner, and shall not again be permitted to conduct, carry on, or engage in, the business of drain laying until satisfactory assurance shall be given to the mayor that such person will thereafter faithfully observe the ordinances of the city and the rules and regulations of the department of public works and until such drain layer shall have made good any loss, damage or expense caused by or on account of any negligence or misconduct on his part which was the cause of the revocation of his license.

1087. Renewal of license.] Any person licensed as a drain layer shall be entitled to have his license renewed without filing application, upon payment by him of the license fee of twenty-five dollars and the renewal of the bond hereinabove provided for.

1088. Penalty.] Any person, firm or corporation violating or failing to comply with any of the provisions of this article shall be fined not less than five dollars nor more than one hundred dollars for each offense.

ARTICLE II.

PUBLIC SEWERS AND DRAINS.

1092. Catch basins—removal of contents.] The contents of catch basins in public streets shall be removed by means of vehicles having boxes made of steel or iron, which boxes shall be not less than eighty cubic feet nor more than one hundred cubic feet in capacity.

ARTICLE III.

MISCELLANEOUS PROVISIONS.

1093. Steam—discharge in sewer prohibited.] No person shall make or use or cause to be made or used any connection with or opening into any sewer or drain for the conveyance or discharge into such sewer or drain of steam from any steam boiler or engine, or from any manufacturing building in which steam is either generated or used, under a penalty of fifty dollars for each and every day during any part of which such connection or opening may have been used for that purpose.

1094. Obstructing sewer—penalty.] No grease, fatty matter, butcher's offal or garbage, dead animals, stone dust or other waste, causing obstructions, or wastes destructive of masonry or obstructions of any kind whatsoever shall be placed, thrown or deposited in any receiving basin, manhole, sewer or waterway; and any person, firm or corporation so offending or causing any such obstruction or substance to be so placed so as to be carried or delivered into such basin, manhole, sewer or waterway, shall be subject to a penalty of ten dollars for each offense; and any person, firm or corporation injuring, breaking, or removing any portion of any receiving basin, covering flag, manhole, vent or drain shall be subject to a penalty of twenty dollars for each offense; nor shall any quantity of marble or other

stone, iron, lead, timber or any other substance, exceeding one ton in weight, be placed or deposited upon any wharf or bulkhead through which any sewer or drain may run; nor upon or over any sewer or drain where the same shall be within three feet of the surface of the street, under a penalty of not more than fifty dollars for each offense, to be recovered of the person, firm or corporation causing or permitting the same.

1095. Excavation around sewer—permit.] Any person who shall uncover or excavate under or around any public sewer in this city, for any purpose whatever, without the written consent of the commissioner of public works, shall be fined not less than ten dollars and not more than fifty dollars for each offense.

1096. Alteration of house drain.] Any person who shall lay, alter or disturb any part of a house drain or drains, catch basin or strainer of such drain or drains, cesspool or water closet, connecting with any public sewer belonging to said city, without being duly licensed to perform the same by said commissioner, shall be fined not less than ten dollars and not more than fifty dollars for each offense.

1097. Plans for buildings—not to be approved unless land is provided with adequate drains.] No plans shall be approved and no permit shall hereafter be issued by the commissioner of buildings for the construction, enlargement, altering, repair or removal of any building on any tract, lot or parcel of land, unless such tract, lot or parcel of land shall be provided with adequate drains connecting with or emptying into a public drain or sewer in accordance with the general ordinances of the city or unless proceedings shall have been instituted to provide such drain or sewer.

1098. Drain construction.] It shall be the duty of any person constructing or using any private drain, sewer, cesspool, water closet pipe or other pipe connecting with or emptying into any public drain or sewer belonging to said city, to construct and use the same strictly in conformity with the orders and directions of the commissioner of public works and the commissioner of health, or either of them, and any person who shall construct or use, or cause to be constructed or used, any such drain, sewer, cesspool or water closet pipe in a different manner from that so ordered and directed by one or both of said commissioners, shall be fined not exceeding fifty dollars for each offense.

1099. Inspection—right of entry.] That the public drains and sewers of the city may be fully protected against improper use and injury, the commissioner of public works and his authorized agents shall have free and unobstructed access to any part of any premises where house drains, cesspools or water closets, connected with or draining into such drains or sewers, are laid, for the purpose of examining the construction, condition and usage of the same, and making necessary alterations or repairs, at any time of the day between the hours of seven o'clock a. m. and six o'clock p. m.; and any owner, occupant or other person, refusing to allow any officer or agent of said commissioner access to the premises for such purposes, shall be fined not less than five dollars nor exceeding fifty dollars for each offense.

HOSPITALS.

1850. Hospital defined.] For the purpose of this article a hospital is hereby defined to mean any institution or place used for the harboring or the reception, care and treatment (including treatments known as rest cure, physical culture, hydropathic massage and all other forms of drugless treatment) of two or more persons suffering from or afflicted with any mental or physical dis-



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ease, bodily injury, alcohol or drug addiction; or any institution or place for the reception and care, temporary or continuous, of one or more women during pregnancy while awaiting confinement, during confinement, or for one month or less after confinement, while recovering therefrom; or any place or establishment advertised, announced, conducted or maintained under the name "hospital" without a qualifying statement that such hospital is not intended for human beings.

1851. License required.] It shall be unlawful for any person, firm, association or corporation other than the regularly constituted authorities of the United States, the state of Illinois, the county of Cook, or the city of Chicago to open, conduct, manage or maintain any hospital as defined in this article within the corporate limits of the city of Chicago without first obtaining a license therefor as hereinafter provided.

1852. Application.] Any person, firm, association or corporation desiring such license shall make written application to the commissioner of health which shall conform to the general provisions of this ordinance relating to applications for licenses, and which shall also state the location or proposed location of the hospital, the purpose for which it is to be opened, conducted or maintained, the accommodations or proposed accommodations for the inmates thereof, the nature and kind of treatment given or proposed to be given therein, the name and address of the chief physician, surgeon or attending chief physician or surgeon or board of physicians or surgeons attendant therein.

1853. Hospital building.] The building or buildings used or to be used as a hospital shall comply with the requirements of the department of buildings and bureau of fire prevention and public safety.

1858. Hospital building board.] For the purposes of this ordinance there is hereby created a hospital building board, which shall be composed of the commissioner of health, the commissioner of buildings and the chief of fire prevention and public safety. The hospital building board shall meet upon call of the commissioner of health and shall make such recommendations to the city council as it may deem necessary or expedient for the construction and erection of new hospital buildings and for changes in buildings now being used or which may hereafter be used for hospital purposes.

1859. Accommodations for patients—regulations as to sanitation.] In every hospital licensed under the provisions of this article each room occupied or to be occupied by a patient or patients, shall be of such dimensions as shall give each adult patient not less than eight hundred cubic feet of space, babies up to six months old, two hundred cubic feet, children from six months to six years, three hundred cubic feet, six years to fourteen years, six hundred cubic feet, with fresh air and floor space in proportion. Every such room shall have at least one window connecting with the external air for each two beds. Said windows shall be of such dimensions as shall secure to each patient at least twenty-four hundred cubic feet of fresh air per hour by natural ventilation, or in case said window shall not secure said twenty-four hundred cubic feet of air per hour by natural ventilation then each room shall, in addition thereto, be fitted with such appliances for ventilation as shall secure to each patient in said room at least twenty-four hundred cubic feet of fresh air per hour. Each bed shall have at least eighty square feet of floor space. In case the same is a maternity hospital, a regularly licensed physician must reside on the premises. Each ward or wing in said hospital shall have running water furnished in one or more places either in said ward or convenient thereto,

so that the same may be adequate and convenient to the occupants thereof. The plumbing, water closets, bath rooms and other sanitary appliances and equipment shall be constructed in accordance with the city ordinances relating thereto. The floor of the cellar or basement in any building used as a hospital shall be properly cemented so as to be water-tight. The halls of each floor shall be open to the external air, with suitable windows, and shall have no room or other obstruction at either end thereof, unless sufficient light or ventilation is otherwise provided for said hall, and the building as a whole shall be provided with adequate and proper fire escapes, stairways, or inclines for exits.

The doors, windows and other direct openings to the external air, of all hospitals, including the kitchen, dining rooms, laundry, toilet rooms, laboratory, morgue and post-mortem rooms of the same, shall be equipped from April 15th to November 15th with screens and appliances necessary for the exclusion of flies.

1862. Frontage consents required—when.] It shall be unlawful for any person, firm or corporation to build, construct, maintain, conduct or manage, in any block in which two-thirds of the buildings fronting on both sides of the street or streets on which the proposed hospital may face or extend, are devoted exclusively to residence purposes, any hospital, unless the owners of a majority of the frontage in such block, and the owners of a majority of the frontage on the opposite side or sides of the street or streets on which said building faces or extends, consent in writing to the building, constructing or maintaining, managing or conducting of any such hospital in such block. Such written consents of the majority of said property owners shall be filed with the commissioner of health before a permit shall be granted for building or constructing any such hospital and before a license shall be issued for the maintaining, conducting or managing of such hospital.

1863. Location of hospital near school or playground.] No hospital of any kind or description shall hereafter be erected or established within four hundred feet of any property used for a public or parochial school or as a public playground.

ARTICLE XI.

HOMES.

1873. Home defined.] For the purpose of this article a home is hereby defined to mean any institution, place or family used for the reception or care, for a longer period than twenty-four hours, of three or more infants or children apart from their parents. A home is further defined to mean any institution used for the reception or care of persons who are dependent or not capable of properly caring for themselves, and shall be understood to include homes for the aged or infirm, orphan asylums, half-orphan asylums, refuges and shelters, and also boarding homes caring for three or more women with their children when such children are less than fourteen years of age.

1879. Accommodations for inmates—regulations as to sanitation.] In every such home each room occupied or to be occupied by inmates shall be of such dimensions as shall give each inmate not less than four hundred cubic feet of air space. Every such room shall have at least one window connecting with the external air for each four beds. Said windows shall be of such dimensions as shall secure to each inmate at least one thousand five hundred cubic feet of fresh air per hour by natural ventilation, or in case said window shall not secure said one thousand five hundred cubic feet of fresh air per hour by natural ventilation,

*Excerpt from "Chicago Commerce"
of Sept. 27-1930*

Asbestos Paper Making in Chicago

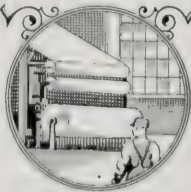
Another basic industry of which Chicago can boast is the production of asbestos paper. The only asbestos paper mill in the city of Chicago and Cook County is owned and operated by the Standard Asbestos Manufacturing company and is located on the north branch of the Chicago river.

Production of asbestos paper is an interesting process. All of the raw material is in the form of crude asbestos fibers imported from Quebec, Canada. This asbestos fiber, with other ingredients, is mixed in large beater engines and, after going through a series of chests, vats, cylinders and dryers, comes out a finished product of smooth white asbestos paper.

The local plant of the Standard Asbestos Manufacturing company produces millions of feet of asbestos paper annually from which is manufactured pipe and boiler insulations, fireproofing materials, insulations for furnaces and hundreds of other materials.

Standard Asbestos Mfg. Co.

MANUFACTURERS AND CONTRACTORS OF
STEAM PIPE AND BOILER COVERINGS
ASBESTOS PAPER AND DEADENING FELTS



820-822 WEST LAKE STREET
CHICAGO

then each room shall, in addition thereto, be fitted with such appliances for ventilation as shall secure to each inmate in said room at least one thousand five hundred cubic feet of fresh air per hour. Each bed shall have at least forty square feet of floor space, and in every room or dormitory containing more than one bed the beds shall be so arranged as to leave a passageway of not less than two feet horizontally on all sides of each bed.

Each ward or wing in said home shall have running water furnished in one or more places, either in said ward or convenient thereto so that the same may be adequate and convenient to occupants thereof. The plumbing, water-closets, bath-rooms and other sanitary appliances and equipment shall be constructed in accordance with the city ordinances relating thereto. The floor of the cellar or basement in any building used as a home shall be properly cemented so as to be water-tight.

The halls of each floor shall be open to the external air with suitable windows, and shall have no room or other obstruction at either end thereof, unless sufficient light or ventilation is otherwise provided for such halls, and the building as a whole shall be provided with adequate and proper fire escapes, stairways or inclines for exits.

All homes, including the culinary department, dining rooms, laundry, laboratory, morgue and post-mortem rooms connected with the same, shall be equipped from May 15th to November 15th with doors, screens and other appliances necessary for the exclusion of flies.

1881. Frontage consents required—when.] It shall be unlawful for any person, firm, association or corporation to build, construct, maintain, conduct or manage a home in any block in which two-thirds of the buildings fronting on both sides of the street or streets on or along which the proposed home may face are devoted exclusively to residence purposes, unless the owners of a majority of the frontage in such block and the owners of a majority of the frontage on the opposite side or sides of the street or streets on or along which said building faces, consent in writing to the building, construction or maintaining, managing or conducting of any such home in such block; provided, however, that no new frontage consents shall be required if such home has heretofore been licensed by the city of Chicago as a hospital, home or nursery at the present location. Such written consents of the majority of said property owners shall be filed with the commissioner of health before a permit shall be granted for the building or constructing of any such home, and before a license shall be issued for the maintaining, conducting or managing of any such home.

UNDERTAKERS—BURIALS.

1902. Frontage consents.] It shall be unlawful for any person, firm or corporation to establish or maintain a morgue or to carry on the business of an undertaker as defined in this article, that receives, in connection with such business, at his or its place of business, the body of any dead person for embalming or other purposes, on or along any boulevard or pleasure driveway, without consent of a majority of the property owners according to the frontage on both sides of such boulevard or pleasure driveway in the block in which such morgue or place of business is located; it shall also be unlawful for any person, firm or corporation to establish or maintain a morgue or to carry on the business of an undertaker, as defined in this article, that receives, in connection with such business, at his or its place of business the body of any dead person for embalming or other purposes, on or along any street in any block in which two-thirds of the buildings on both sides of

the street are used exclusively for residence purposes, without the written consent of a majority of the property owners according to the frontage on both sides of such street in such block; provided that nothing herein contained shall apply to such location in the case of any person licensed as an undertaker and authorized to carry on such business at any such location at the time of the passage of this ordinance, nor to any block in any street on which street cars are operated. Such frontage consents shall be obtained and filed with the department of health before a license shall issue for such business.

1903. Undertaking rooms.] No person shall be licensed to carry on the business of undertaking in any establishment, store or place, unless such establishment, store or place shall be provided with a compartment or room completely shut off or capable of being completely shut off from the other parts of such establishment, store or place; such compartment or room shall have free outside ventilation and light, and its floor shall be constructed of or covered with a non-absorbent material and shall be connected with a sewer by an approved sanitary drain.

1921. Undertaker's place not to be used as a public morgue.] No person licensed as an undertaker under the provisions of this article shall permit or allow any room, store, place or establishment conducted, used, operated or maintained by him in the undertaking business to be used as a public morgue. If any dead human body is brought to any such room, store, place or establishment, and if arrangements are not made for the burial or cremation of such body within one hundred hours from and after the hour of death, the body shall be taken by the undertaker to the Cook county morgue, or placed by him in one of the cemetery receiving vaults.

ARTICLE XXXI.

HEATING TENEMENT HOUSES, FACTORIES AND WORKSHOPS.

2119. Required temperature—complaints.] It shall be the duty of every person, firm or corporation owning or controlling the heating plant which furnishes heat to any tenement house, hotel, lodging house, rooming house or boarding house, as defined by the ordinances of the city, in which the heat is furnished from a heating plant used in common for the purpose of heating the various rooms and apartments therein, and such heating plant is under the control or supervision of such owner or person in control of such building, to furnish heat to such rooms and apartments from October 1st of each year to June 1st of the succeeding year, so that the occupants thereof may secure, without such undue restriction of ventilation as to interfere with proper sanitary conditions, a minimum temperature of 60 degrees Fahrenheit at 6:30 a. m., 65 degrees at 7:30 a. m., and 68 degrees at 8:30 a. m., and thereafter until 10:30 p. m., averaged throughout the apartment; provided, that written notice of complaint concerning lack of heat in such room or apartment shall first be given to such person, firm or corporation, owning or controlling such tenement house by registered mail before any person shall be deemed to have violated this section.

Amended January 2, 1924.

2120. Method of determining temperature. For the purpose of determining whether or not the temperature in any such room or apartment is in accordance with the provisions of the preceding section, temperature readings shall be made only by an inspector of the department of health by means of a standard Fahrenheit thermometer approved by the department of health in not less than two separate rooms in such apartment, or if

the apartment consists of only one room then in two opposite parts of the room as near the extremes as practicable, such thermometer to be placed at a point not less than four feet nor more than six feet away from any door or window leading to the outer air. Failure to furnish the heat required in the preceding section shall not constitute an offense where it is due to a breakdown of the heating plant, if diligence is used to have such plant repaired (unless such breakdown has been caused by the violation of an existing ordinance relating to the operation of heating plants), nor where it is due to strikes, to general shortage of fuel, to any act of the tenant who makes the complaint, or to any cause beyond the owner's control, unless written notice of such failure to furnish the heat hereby required shall first have been given to the owner or agent of the building by registered mail, and the temperature readings herein provided for shall not be made until after the delivery of such registered letter to the addressee thereof.

Amended January 2, 1924.

2121. Required temperature in factories—moisture content.] It shall be the duty of every person firm or corporation owning or controlling the heating plant which furnishes heat to any factory or workshop as defined by this ordinance, to maintain a temperature within such factory or workshop of not less than 68 degrees Fahrenheit without such undue restriction of ventilation as to interfere with proper sanitary conditions therein; provided, however, that this requirement shall not apply to any factory or workshop where the business conducted therein is of such a nature that a higher or lower temperature than 68 degrees Fahrenheit is necessary or expedient for the work, trade, occupation or manufacturing processes of the business so conducted therein; and provided further, that in all such cases, when such higher or lower temperature is necessary or expedient, the moisture content of the air shall be increased where the temperature is maintained below 68 degrees Fahrenheit or decreased where the temperature is maintained above 68 degrees Fahrenheit in the proper amount to maintain a wet bulb temperature between 54 degrees and 58 degrees Fahrenheit, and in the case of special manufacturing processes where it is necessary or expedient to maintain a wet bulb temperature below or above the extremes herein set forth, the commissioner of health shall prescribe and enforce such reasonable precautions and safeguards as will meet the requirements of such special manufacturing processes without endangering the health of the occupants of such factory or workshops. The manner of determining the temperature in all cases where the temperature to be maintained is 68 degrees Fahrenheit shall be the same as in section 2120, and in all other cases shall be in such practical manner as in the commissioner of health may determine.

2121a. Required Temperatures in Offices Stores, and Places of Employment.] It shall be the duty of any person, firm or corporation owning or controlling the heating plant which furnishes heat to any office, store or other place of employment, to maintain a temperature within such office, store or place of employment of not less than 68 degrees Fahrenheit without such undue restriction of ventilation as to interfere with proper sanitary conditions therein, between the hours of 8:00 A. M. and 6:00 P. M., from October first of each year to June first of the succeeding year, Sundays and full legal holidays excepted.

2122. Penalty.] Any person, firm or corporation owning or controlling a tenement house, hotel, lodging house, rooming house or boarding house, as defined by the ordinances of the city in which the heat is furnished as described in section 2119, owning or controlling the heating plant which

furnishes heat to any factory or workshop, office, store, or other place of employment as described in sections 2121 and 2121a, that violates any of the provisions of this article or neglects or refuses to comply therewith, after notice from the department of health as herein provided, shall, upon conviction thereof, be fined not less than twenty-five dollars nor more than two-hundred dollars for each offense, and a separate offense shall be deemed to have been committed each day that a violation of this article continues; provided, that no more than one fine shall be imposed for violations in the same building occurring on any one day.

ARTICLE XXXII.

DIVISION OF AIR CONDITIONS CONTROL.

2123. Division of air conditions control established in the department of health—duties.] There is hereby established a division of the department of health of the city of Chicago to be known and designated as the division of air conditions control. All employees in said division shall be appointed according to law and shall be under the supervision and control of the commissioner of health.

The division of air conditions control shall be charged with the inspection and control of the installation and maintenance of heating and ventilating equipment, the inspection of rooms for natural and mechanical ventilation, the prevention and abatement of smoke, gas and fume nuisances, the examination and approval of plans of all heating and ventilation installations, and of all smoke, gas and fume creating prevention and abatement installations installed or reconstructed in any building, location or on any premises within the city of Chicago.

2124. Head of division—qualifications—duties.] The head of the division of air conditions control shall be an engineer qualified by technical training in the theory and practice of heating, ventilation and air conditioning. He shall also be experienced in and thoroughly familiar with the design, construction and operation of steam boilers and furnaces and in the theory and practice of smoke prevention and abatement.

Under the direction of the commissioner of health, he shall have charge of the division of air conditions control, shall supervise and direct its operations and shall be charged with the enforcement of all laws of the state and ordinances of the city relative to the preservation of the purity of the air. He shall conduct, or cause to be conducted, investigations and studies of the condition of the air of the city and the measures necessary to preserve the same in the highest possible degree of purity.

2125. Assistants and employees.] There shall also be employed in the division of air conditions control, such engineers, inspectors, assistant inspectors, deputy inspectors and other employees as shall be provided for by the city council.

2126. Construction and reconstruction of plants—plans and specifications—permit—Commissioner of buildings to supervise.] No new plants nor any reconstruction of any existing plant for producing power and heat, or either of them, nor any new chimney connected with a steam plant, shall be erected or maintained in the city until plans and specifications of the same have been filed in the office of and approved by the commissioner of health and a permit issued by him for such erection, reconstruction or maintenance. Plans and specifications to be filed with the commissioner of health shall show the amount of work and the amount of heating to be done by such plant and all appurtenances thereto, including all provisions made for the purpose of securing complete combustion of the fuel to be used and for

the purpose of preventing smoke; said plans and specifications shall also contain a statement of the kind of fuel proposed to be used and shall also show that the room or apartment in which such plant shall be located is provided with doors, windows, air-shafts, fans and other means of ventilation sufficient to prevent the temperature of such room, apartment, basement or other portion of such building, wherein such steam plant or apparatus is to be used, from rising to a point higher than one hundred and twenty degrees Fahrenheit, and sufficient also to provide that the atmosphere of any such apartment, wherein such apparatus may be located, may be entirely changed every ten minutes. Upon the approval of such plans and specifications a duplicate set of which shall be left on file in said office, and upon the payment of the fees as hereinafter provided, the commissioner of health shall issue a permit for the reconstruction, erection or maintenance of such plant. As soon as the commissioner of health has examined the plans and specifications submitted, and has issued a permit as above provided, he shall notify the commissioner of buildings to see that the execution of the work permitted is carried out in conformity with the plans and specifications, with special reference to the amount of space used, the size and construction of the chimney or chimneys used, the provision for the prevention of smoke, and the provisions for ventilation, and for the proper temperature in the engine and boiler rooms.

2127. Use of plant—certificate of commissioner of health required.] It shall be unlawful for any person to use any new or reconstructed plant for the production and generation of heat and power, or either of them, until he shall have first procured a certificate from the commissioner of health certifying that the plant is so constructed that it will do the work required, and that it can be so managed that no dense smoke shall be emitted from the chimney connected with the furnace or firebox.

2128. High-pressure boilers—repairs—permit required—penalty.] No owner shall alter or repair any brick work on or about a high-pressure boiler without first submitting plans and specifications to the commissioner of health and securing a permit therefor and such work shall be done only by one properly licensed therefor. Any person who shall violate this section shall be liable to a fine of twenty-five dollars for each day upon which he shall prosecute such alteration, change or installation without a permit, and each day's violation shall constitute a separate offense.

2129. Emission of dense smoke—regulations—abatement—penalty.] The emission of dense smoke within the city from the smoke stack of any locomotive, steam boat, steam tug, steam roller, steam derrick, steam pile driver, tar kettle or other similar machine or contrivance, or from the smokestack or chimney of any building or premises, except for a period of six minutes in any one hour during which the fire box is being cleaned out or a new fire being built therein, is hereby declared to be a nuisance and may be summarily abated by the commissioner of health or by any one whom he may duly authorize for such purpose. Such abatement may be in addition to the fine hereinafter provided. Any person, firm or corporation owning, operating or in charge or control of any locomotive, steam boat, steam tug, steam roller, steam derrick, steam pile driver, tar kettle or other similar machine or contrivance, or

from the smokestack or chimney of any building or premises so owned, controlled or in charge of him or it, except for a period of six minutes in any one hour during which the fire box is being cleaned out or a new fire being built therein, shall be deemed guilty of a violation of this section, and upon conviction thereof shall be fined not less than ten dollars nor more than one hundred dollars for each offense; and each emission of dense smoke in violation of the provisions of this section shall constitute a separate offense for each and every day on which such violation shall continue.

TENEMENT AND LODGING HOUSES.

2134. Conform to requirements.] No house or building hereafter erected shall be used as a tenement house or lodging house, and no house or building heretofore erected and not now used for such purposes shall be converted into, used or leased for a tenement or lodging house, unless, in addition to the requirements hereinbefore contained in article IX of chapter XVII of this ordinance, it conforms to requirements affecting tenement or lodging houses, or both, as specified in the following sections of this article.

2135. Distances between buildings on same lot.] It shall not be lawful hereafter to erect for or convert to the purpose of a lodging house any building on any lot, other than a corner lot, where there is another building on the same lot, unless there is a clear, open space exclusively belonging thereto, and extending upward from the ground, of at least ten feet between such buildings, if they are one story high above the level of the ground; if they are two stories high, the distance between them shall not be less than fifteen feet; if they are three stories high, the distance between them shall not be less than twenty feet; and if they are more than three stories high, the distance between them shall be not less than twenty-five feet.

2136. Height of ceilings—windows.] In every such house hereafter erected or converted, every habitable room except rooms in the attic shall be in every part not less than eight feet in height from the floor to the ceiling; and every habitable room in the attic of any such building shall be at least eight feet in height from the floor to the ceiling throughout not less than one-half the area of such room. Every such room shall have at least one window connecting with the external air, or over the door an adequate ventilator connecting it with a room or hall which has a connection with the external air, and so arranged as to produce a cross current of air. The total area of window or windows in every room communicating with the external air shall be at least one-tenth of the superficial area of every such room; and the top of one at least of such windows shall not be less than seven feet and six inches above the floor, and the upper half at least shall be made so as to open the full width. Every habitable room of a less area than one hundred superficial feet, if it does not communicate directly with the air, and is without an open fireplace, shall be provided with a special means of ventilation by a separate air shaft extending to the roof, or otherwise, as the commissioner of buildings may prescribe.

2137. Lodging house—ventilation.] Every house, building, or portion thereof in the city, designed to be used, occupied, leased or rented, or which is used, occupied, leased or rented, for a lodging house, shall have in every room which is occupied as a sleeping room and which does not communicate directly with the external air a ventilating or transom window having an opening or area of three square feet over the door leading

into and connected with the adjoining room, if such adjoining room communicates with the external air, and also a ventilating or transom window of the same opening or area communicating with the entry or hall of the house; or where this is from the relative situation of the rooms impracticable, such last mentioned ventilating or transom window shall communicate with an adjoining room that itself communicates with the entry or hall. Every such house or building shall have in the roof at the top of the hall an adequate and proper ventilator. No room in any lodging house shall be so occupied that the allowance of air to each person living or sleeping in such room shall at any time be less than four hundred cubic feet for each such person more than twelve years old and two hundred cubic feet for each such person of the age of twelve years or under.

2138. Water supply—cellar floor—ventilation of halls.] Every such house hereafter erected or converted shall have proper conveniences and receptacles for ashes and rubbish; it shall have water furnished at one or more places in such house or in the yard thereof, so that the same may be adequate and reasonably convenient for the use of the occupants thereof; it shall have the floor of the cellar properly cemented so as to be water-tight; the halls of each floor shall open directly to the external air, with suitable windows, and shall have no room or other obstruction at the end, unless sufficient light or ventilation is otherwise provided for said hall in a manner approved by the commissioner of buildings.

2146. Lodging house defined.] A lodging house shall be taken to mean and include any house or building or portion thereof in which persons are harbored or received or lodged for hire for a single night or for less than a week at one time, or any part of which is let for any person to sleep in for any term less than a week.

2147. Penalty.] Any person who shall violate, disobey, neglect, or refuse to comply with, or resist, any of the provisions of this article, or who refuses to comply with any of the sanitary regulations of the department of health concerning any of the matters or things mentioned in this article shall be fined not less than ten dollars nor more than two hundred dollars for each offense.

VENTILATION.

2152. Classes of buildings.] Whenever reference is made in this article to any class of buildings it shall be understood as meaning the kind of building designated in the same way in chapter XVII of this ordinance.

2153. Ventilation in buildings.] (a) The air in any room used as an auditorium in buildings of classes IVb, IVc, IVd and V hereafter erected, and the air in any room used as a class room or assembly hall in buildings of class VIII hereafter erected, shall be changed so as to provide each person for whom seating accommodation is provided in such auditorium, class room or assembly hall with at least fifteen hundred cubic feet of air per hour.

(b) In buildings of class VII hereafter erected, on floors frequented by the public, the air in such rooms shall be supplied at the following rates:

For each person in basement, two thousand cubic feet per hour.

For each person in first to third stories, both inclusive, fifteen hundred cubic feet per hour.

For each person in fourth story and above, except as hereinafter provided, thirteen hundred cubic feet per hour.

(c) For the purpose of determining the number of people on any floor in buildings of class VII, in calculating the means of ventilation, the following floor area per person per floor shall be taken as the basis.

Basement, per person, twenty square feet of floor area, exclusive of walls, stairs and elevators.

First story, per person, fifty square feet of floor area, exclusive of walls, stairs, elevators and inclosed show windows.

Second story, per person, fifty square feet of floor area, exclusive of walls, stairs, elevators and inclosed show windows.

Third story, per person, sixty square feet of floor area, exclusive of walls, stairs and elevators.

Fourth story and above, per person, eighty square feet of floor area, exclusive of walls, stairs and elevators, except as hereinafter provided.

(d) Grocery departments and restaurants, per person, forty square feet of floor area, exclusive of walls, stairs and elevators.

(e) The amount of carbon dioxide in the air of any such auditorium, class room or assembly hall or space frequented by the public, in class VII buildings, shall not be permitted to rise above ten parts of carbon dioxide per ten thousand parts of air, measurements being taken at levels from two and one-half to eight feet above the floor, generally distributed, and the temperature in such spaces, when artificially heated, shall not exceed sixty-eight degrees Fahrenheit. Relative humidity shall not be less than forty-five degrees nor more than eighty degrees.

(f) The air in any room used as an auditorium in buildings of classes IV and V constructed prior to March 13, 1911, and the air in any room used as a class room or assembly hall in buildings of class VIII constructed prior to said date, shall be changed, so as to provide each person for whom seating accommodation is provided in such auditorium, class room or assembly hall with at least twelve hundred cubic feet of air per hour.

(g) The air in any rooms and floors in buildings of class VII erected prior to March 13, 1911, shall be supplied, by mechanical or other means, at the following rates:

For each person in basement, sixteen hundred cubic feet per hour.

For each person in first to third stories, both inclusive, twelve hundred cubic feet per hour.

For each person in fourth story and above, except as hereinafter provided, ten hundred and forty cubic feet per hour.

For each person in grocery departments and restaurants, twelve hundred cubic feet per hour.

(h) For the purpose of determining the number of people on any floor in buildings of class VII, in calculating the means of ventilation, the following floor area per person per floor shall be taken as the basis:

Basement, per person, twenty square feet of floor area, exclusive of walls, stairs and elevators.

First story, per person, twenty square feet of floor area, exclusive of walls, stairs, elevators and inclosed show windows.

Second story, per person, fifty square feet of floor area, exclusive of walls, stairs, elevators, and inclosed show windows.

Third story, per person, sixty square feet of floor area, exclusive of walls, stairs and elevators.

Fourth story and above, per person, eighty square feet of floor area exclusive of walls, stairs and elevators, except as hereinafter provided.

Grocery departments and restaurants, per person, forty square feet of floor area, exclusive of walls, stairs and elevators.

(i) The amount of carbon dioxide in the air of any such auditorium, class room or assembly hall or space frequented by the public in class VII buildings shall not be permitted to rise above twelve parts of carbon dioxide per ten thousand parts of air, measurements being taken at levels from two and one-half feet to eight feet above the floor, generally distributed; and the temperature in such places, when artificially heated, shall not exceed seventy degrees Fahrenheit. The relative humidity shall not be less than forty degrees nor more than eighty-five degrees.

(j) The word "auditorium," as used in this section in connection with buildings of classes IV and V, shall be construed as including the main floor, balcony and galleries.

(k) In buildings hereafter erected for, or converted to, the use of a factory, mill or workshop, the air shall be changed, except as hereinafter provided, so as to provide each person for whom working accommodations are provided therein with at least fifteen hundred cubic feet of air per hour.

(l) In buildings used for the purpose of a factory, mill or workshop at the time of the passage of this ordinance, the air shall be changed, except as hereinafter provided, so as to provide each person for whom working accommodations are provided therein with at least twelve hundred cubic feet of air per hour.

(m) In any building or room hereafter erected for, or converted to the use of, a factory, mill or workshop, the amount of carbon dioxide in the air, except as hereinafter provided, shall not be permitted to rise above ten parts of carbon dioxide per ten thousand parts of air.

(n) In buildings or rooms used for the purpose of a factory, mill or workshop at the time of the passage of this ordinance, the amount of carbon dioxide in the air, except as hereinafter provided, shall not be permitted to rise above twelve parts of carbon dioxide per ten thousand parts of air. The measurements in each case above enumerated in this paragraph shall be taken at levels from two and one-half feet to eight feet above the floor, distributed generally; and the temperature in such spaces, when artificially heated, shall not exceed sixty-eight degrees Fahrenheit, except as hereinafter provided; the relative humidity shall not be less than forty degrees nor more than eighty-five degrees.

(o) The above provisions and standards as to ventilation shall not apply to storage rooms or vaults or any place where the manufacturing processes therein conducted would be materially interfered with, or where manufacturing processes therein conducted would produce considerable quantities of free carbon dioxide, except that the air in such rooms or vaults or in any places of manufacture shall not be permitted to become detrimental to the health of those who enter or work therein.

(p) No part of the fresh air supplied in compliance with the requirements of this section shall be taken from any cellar or basement.

(q) No person, firm or corporation, either as owner, proprietor, lessee, manager or superintendent of any factory, mill, workshop or any other building where one or more persons are employed, shall cause, permit or allow the same or any portion or apartment of any room in such factory, mill or workshop, to be overcrowded or to have inadequate, faulty or insufficient light or ventilation.

(r) No person shall be exposed to any direct draft from any air inlet, nor to any draft having a temperature of less than sixty degrees.

(s) All poisonous or noxious fumes or gases arising from any process, and all dust of a character injurious to the health of persons employed, which is created in the course of a manufacturing process, within such factory, mill, workshop or laundry, shall be removed, as far as practicable, by either ventilating or exhaust devices.

2154. Charges for approval of plans for mechanical ventilation equipment.] The commissioner of health shall make the following charges for the approval of plans for mechanical ventilation equipment and for the inspection and testing of the same.

Five dollars for an equipment handling five thousand cubic feet of air per minute, or less, and one dollar for each additional capacity of one thousand cubic feet per minute.

The owner or contractor shall be granted a certificate of inspection when the final inspection and test is made and the fee paid.

No fee for minor alterations shall be charged unless the alterations include changes in the method of ventilating or in the total capacity of the equipment, in which case the charge will be one dollar for every one thousand cubic feet of air per minute additional capacity.

2155. Annual inspection fee.] An annual inspection of all mechanical ventilation equipment in public and semi-public buildings and places of employment shall be made by the commissioner of health to see that the same is in proper operating condition. The fee for the annual inspection shall be fifty cents per one thousand cubic feet or fraction thereof, of air handled per minute. Such annual inspection fee shall be paid in advance to the city collector on the first day of March of each year.

2156. Penalty.] Any person, firm or corporation violating or failing to comply with any of the provisions of this article shall be fined not less than five dollars nor more than two hundred dollars for each offense, and every day on which such violation shall continue shall be deemed a distinct and separate offense.

STORES, FACTORIES, WORKSHOPS— MISCELLANEOUS PROVISIONS.

2157. Ventilation of stores, factories, workshops, etc.] No person, firm or corporation, being the owner, proprietor, lessee, manager or superintendent of any store, factory, workshop or other structure or place of employment where workmen and workwomen are employed for wages, shall cause, permit or allow the same or any portion or apartment of, or any room in such store, factory, workshop or other structure or place of employment, to be overcrowded or inadequate, faulty or insufficient in respect of light, ventilation, heat and cleanliness; and in every such building or apartment, or room in any such building, where one or more persons are employed as aforesaid, at least five hundred cubic feet of air space shall be allowed to each and every person employed therein, and fresh air supplied by ventilation at the rate of four complete changes of air per hour during the hours of employment. No part of such air supply shall be taken from any cellar or basement.

2160. Seats for females.] It shall be the duty of all employers of females in any mercantile or manufacturing business or occupation to provide and maintain seats for the use of such female employees, and to permit, to a reasonable extent, the use of

such seats by such employes during the hours of their employment, for the preservation of their health. Seats shall be furnished at the ratio of one seat for every four female employes. All mercantile and manufacturing occupations and establishments where females are employed shall be inspected by officers of the health department to ascertain if this section is complied with, and any employer violating any of the provisions of this section shall be subject to a fine of not less than five dollars nor more than one hundred dollars.

2161. Penalty.] Any person violating, disobeying, neglecting or refusing to comply with any of the provisions of this article, where no other penalty has been provided, shall be fined not less than ten nor more than one hundred dollars for each offense.

2175. Adequate water closets.] Every person who shall be the owner, lessee or keeper or manager of any tenement house, boarding house, lodging or manufactory, shall provide or cause to be provided for the accommodation thereof and for the use of the tenants, lodgers, boarders and workers therein, adequate privies, urinals and water closets, and the same shall be so ventilated, and shall at all times be kept in such cleanly and wholesome condition as not to be offensive to the persons within the building or to the public or be dangerous or detrimental to health.

2176. Roofs—drainage.] The roof of every house shall be kept in good repair and so as not to leak, and all rain water shall be so drained or conveyed therefrom as to prevent its dripping on the ground, or causing dampness in the walls, yard or area.

2177. Drainage from premises where no sewer exists.] Where no sewer exists in the street, the yard or area of all premises shall be so graded that all water from the roof or otherwise, and all filth, shall flow freely from such premises and all parts of same into the street gutter, by a passage beneath the sidewalk, but so arranged as to be by a permanent cover, but so arranged as to permit access to remove obstructions or impurities. No such passage or drain or any appurtenance thereof, shall be permitted to become filthy or offensive, or to create a nuisance.

2178. Cisterns.] No cistern for the collection and storage of rain water from roofs shall be constructed or placed within any building that is used for human habitation or occupancy.

2179. Overflow from cistern.] No cistern used for the collection and storage of rain water from roofs shall have its overflow pipe directly connected with any sewer or drain.

If any overflow pipe is provided for any such cistern, such pipe shall lead to an area or gutter and shall have its outlet protected with a suitable metal screen.

2180. Water closets, etc.—prevention of sewer gas.] No water closet, sink, tub, vat or other structure shall hereafter be constructed within the city having connection with or by any sewer or underground passage, unless the same is provided with adequate or the best generally approved constructions and precautions for preventing gases and other offensive currents, substances and smells from passing up or out through such connection from such sewer or passage; nor shall any such water closet or privy be constructed without adequate provisions for the effectual and proper ventilation and cleansing thereof.

2181. Penalty.] Any person, firm or corporation that violates or fails or refuses to

comply with any of the provisions of this article, or resists any officer in the discharge of his duty concerning any of the matters in this article contained, where no other penalty is specifically provided, shall be fined not less than ten dollars and not more than two hundred dollars for each offense.

LAUNDRIES.

2375. Laundry defined.] Any place, building, structure, room, establishment, or portion thereof, which is used for the purpose of washing, drying, starching, or ironing shirts, dresses, underwear, collars, cuffs or other wearing apparel, table, bed or other household linens, towels, curtains, draperies or other washable fabrics, such work being done for the general public, shall be deemed a laundry and subject to the provisions of this chapter.

The word "laundry," as used in this chapter, shall also be held to include any private laundry maintained or operated in connection with any hotel, restaurant or public institution, except a hospital or charitable institution where no charge is made for laundry services.

The provisions of this chapter shall not apply to any female engaged in doing custom laundry work at her home for a regular family trade, nor to any room, rooms or portion thereof, located in a tenement house or other dwelling, in which domestic laundry work is done by or for the occupants of such building exclusively.

2379. Penalty.] Any person, firm or corporation that shall hereafter establish, maintain, conduct, carry on or operate a laundry without first procuring a license so to do, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense, and each day or fraction of a day on which such person, firm or corporation shall maintain any laundry without a license shall be construed as a separate and distinct offense.

SANITARY REQUIREMENTS.

2380. Natural lights required—windows and skylights not to be obstructed.] No laundry shall be established, maintained, conducted or operated in any cellar, basement, or in any other room or place in any building which is not provided with sufficient natural light, by means of windows or skylights, so that on clear days, during the period between one hour after sunrise and two hours before sunset on sunshiny days, illuminometer tests shall show a minimum illumination of five foot candles in all parts of such room or place, not directly obstructed by machinery or other equipment. The general arrangement of all machinery and equipment in such laundry shall be such as not to unnecessarily obstruct the lighting and ventilating through such windows and skylights.

2381. Sleeping in laundries prohibited.] No person shall be permitted to sleep in any laundry, nor shall any sleeping room or living room be in direct communication with any laundry. No laundered or unlaundered fabric belonging to the trade of any laundry shall be stored or kept in any room which is used for living purposes.

2382. Sanitary conditions.] Every room or place used as a laundry, or for the storage of unlaundered or laundered fabrics in connection therewith, shall, at all times, be kept in good repair and maintained in a clean and sanitary condition as to floors, walls, ceilings, windows, woodwork, machinery, utensils and fixtures, and every such room or place shall be kept free from rats, mice and vermin, and all matters of an infectious or contagious nature.

No person who has tuberculosis, any acute or active venereal disease, any communicable or loathsome skin disease, or any other communicable disease, shall work in any laundry, and no owner, proprietor, manager or person in charge of any laundry shall knowingly require, permit or suffer any such person to be employed therein.

No wall paper shall be applied upon the walls or ceilings of any room used for laundry purposes.

2383. Clear height between ceiling and floor—ventilation—cubic feet of air space per person.] No laundry shall be established, maintained, conducted, or operated in any room or place in which the clear height between the ceiling and the finished floor is less than ten feet, or which is not ventilated by means of windows, skylight, air shafts, air ducts, or mechanical apparatus so that a complete change of air in all parts of such room or place may be made at least four times each hour; and in every such room or place at least one thousand cubic feet of air space shall be provided for each and every person employed therein; provided that any laundry now in existence may be maintained and operated at its present location in any room or place in which the clear height between the ceiling and the finished floor does not fall below eight feet, six inches.

Every room in any laundry (except the room or rooms used for drying purposes) in which the temperature and humidity are such as in the judgment of the commissioner of health might endanger the health of the persons employed therein shall be provided with a mechanical ventilating system approved by the commissioner of health.

2384. Floor—how constructed.] The floor of every laundry and every room or place in connection therewith, except the room or rooms in which wearing apparel, household linens, bedding, towels, or other fabrics are washed, shall be constructed of hardwood or any impervious material. The floor of the room or rooms in which wearing apparel, household linens, bedding, towels, or other fabrics are washed shall be constructed of hardwood with tight joints, concrete, cement, tile or stone laid in cement, or other impervious material, and shall be water-tight and properly drained to the public sewer. The angles where the floor and wall

join shall likewise be water-tight. Provided that in laundries hereafter established, the floor of the wash room shall be of concrete, cement, tile, or stone laid in cement, or other impervious material, and shall be water-tight and properly drained to the public sewer.

2385. Plumbing and drainage facilities—plumbing fixtures.] Every laundry shall be provided with adequate sanitary plumbing and drainage facilities, and the installation of all drains and plumbing fixtures shall be in accordance with the requirements of the ordinance of the city at the time they are installed. Every water closet, sink, or other plumbing fixture, installed therein shall be of an approved type, impermeable and thoroughly sanitary.

2386. Water closet accommodations.] Every laundry shall be provided with separate water closet facilities for male and female employees, and every room or compartment in which any water closet is installed shall be provided with adequate natural ventilation by means of windows or skylights opening to the external air.

2387. Lavatory facilities—separate room or space for wraps or outer clothing of employees.] Every laundry shall be provided with sufficient and suitable lavatory facilities, including approved wash bowls, wash basins, or sinks, supplied with hot and cold running water, soap, clean individual towels, and such other equipment as the commissioner of health may deem necessary for the health and comfort of the persons employed therein.

A separate room, or sufficient space in a room, which is entirely separate from the room or rooms in which wearing apparel linen or other fabrics are washed or dried, and which can be maintained in a dry and sanitary condition, shall be provided and maintained in every laundry as a cloak or locker room in which employees may keep their wraps or outer clothing, and if the management of any laundry shall require the persons employed therein to wear any special or designated garment during the hours of employment, such space or room shall be so arranged that employees may make such changes as may be necessary with a reasonable degree of privacy.

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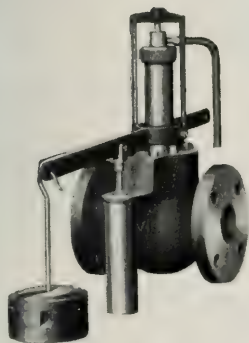
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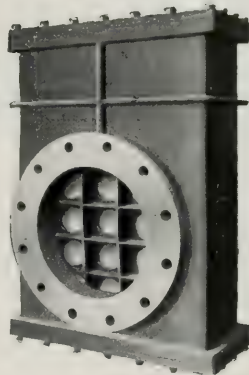
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spout, to carry contamination to a drinker's lips.

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MODERN SANITATION OF BUILDINGS

By LEO H. PLEINS, Architect and Sanitary Engineer

The primary object of this article is to present to Architects in as brief a form as possible, data, which the writer trusts may be of service in their office practice in the preparation of plans and specifications covering plumbing work.

The great importance of sanitary plumbing work is daily becoming more and more recognized and hence if the Architect is to give his client full service, plumbing must be given the same careful consideration as the other structural parts of the building.

For convenience of reference the article is arranged under four headings—"Drainage of Building";—"The Water Supply";—"Arrangement of Toilet and Bath Rooms"; and "Plumbing Fixtures". Space does not permit of covering all that may be said under each heading, but endeavor has been made to mention characteristic features of importance, that should be given consideration in the proper analysis of each particular problem.

DRAINAGE OF BUILDINGS.

I. Proper Fall to Main Sewer. When a survey is made the location and size of main sewer should be indicated thereon. If stubs to curb are in place their location, size and grade should be shown. The basement floor grade should always be given and also grade of main sewer at curb or street. The desirable grade for house sewer connections is $\frac{1}{4}$ " to one foot. If this cannot be obtained, the grade may be reduced but in this case the size of the tile pipe must be increased according to the length of the connection from building to main sewer.

See Table I for carrying capacity of tile pipe at varying grades. Discharge is given in cubic feet per second. Convert this into gallons by multiplying by 7.50

In the absence of any regulation as to size of house connections to main sewer, the minimum size of such connection shall be 6" tile pipe; unless a larger size is required for drainage after careful calculation. See "Size of Main House Drain," page 617.

II. When Main Sewer is Above Level of Basement Floor Grade: In this case all drainage from floor drains or fixtures in basement must be run to a sump basin and elevated by means of a pump. If no water closets or urinals are to be installed in basement the pump will be described as a **bilge** pump. If water closets and urinals are to be provided in basement, the pump will be described as a **sewage ejector**.

Obviously all waste and soil lines that may be drained by gravity, such as all drainage from floors above the basement shall be run into a horizontal line and this carried under ceiling of basement and thence through the wall connecting to the main sewer at such distance below grade as necessary to prop-

erly drain the system. The discharge from Bilge Pump or Sewage Ejector shall be connected into the horizontal line under ceiling of basement at such point inside of building as may be convenient.

If a Bilge Pump is installed—the basin for a single pump should be as follows: For pump from 10 to 30 gallons per minute, basin to be 30" diameter; for a pump from 50 to 100 gallons per minute, basin to be 36" diameter and for a pump from 125 to 200 gallons per minute, basin to be 42" diameter. For two or duplex pumps—basin to be 48" diameter for pumps from 100 to 125 gallons per minute and 60" in diameter for pumps of 150 to 200 gallons per minute capacity. All basins should be 36" deeper than lowest inlet entering the same.

If a Sewage Ejector is installed, the basin for a single ejector shall be as follows: For an ejector from 50 to 75 gallons per minute—basin to be 36" in diameter; for an ejector of from 100 to 200 gallons per minute, the basin should be 42" diameter and for an ejector of 250 to 350 gallons per minute, the basin should be 48" in diameter. For two or duplex ejectors, the basin to be 48" in diameter for ejectors of from 50 to 100 gallons per minute and 60" in diameter for ejectors of from 125 to 350 gallons per minute. All basins should be 48" deeper than the lowest inlet entering the same.

The best motive power for Bilge pumps or Sewage ejectors is a direct connected vertical type electric motor—the operation of which is automatically controlled by means of a float switch.

Wherever possible, both Bilge pumps and Sewage ejectors should be installed in duplicate sets. With duplex pumps the automatic control is arranged so that the same will start one pump when the water level has raised, holding the second pump in reserve, and starting the second pump when the first is not capable of handling all the water. Both pumps will then operate until normal condition has been restored. The automatic control should be provided with a four-pole transfer switch so connected up that by throwing over switch, each pump will operate at alternate periods, holding the other as reserve and in this way, equalize the wear on the pumps.

Always ascertain and specify the correct electric current and provide for service wires to within 5 feet of pump to be furnished by contractor for Electrical Work. If current is Direct give the voltage and if current is Alternating give voltage cycles and phase.

The motors for pumps are usually mounted on a cast iron or steel cover which forms a support for motors, contact apparatus etc. The basins may be of cast iron, steel, brick or concrete. If of the latter materials basins must be thoroughly waterproofed.

A swinging check valve, cast iron body, brass mounted must be placed in the horizontal discharge pipe between pump and sewer.

Blow-off drainage from boilers cannot be run directly into bilge pump or sewage ejector basins—but must always discharge into a cast iron or steel blow-off basin or muffler



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tank. From this basin the drainage may then be run to bilge or sewage ejector basins, if it is impossible to drain the same by gravity.

Boiler Blow-Off Basins:

These are usually included under the heading of "Heating Work." The contractor for this work makes all connections between same, boiler blow-offs, drips, etc. When directly connected to the house sewage line the plumbing contractor makes such connection as also the venting of blow-off ba-

To determine the proper size for downspouts the following may be of service.

A rainfall of 1-inch in depth on an area of 100 square feet will give a run off of 62 gallons.

Downspouts proportioned as follows have been found in practice to give satisfactory results. For small roofs, 1 sq. inch in sectional area of the leader for each 150 sq. ft. of roof surface. For medium sized roofs 1 sq. in. in sectional area of the leader for each 200 sq. ft. of roof surface. For large roofs,

Diam eter.	Slope, or Head Divided by Length of Pipe.							
	1 in 40	1 in 70	1 in 100	1 in 200	1 in 300	1 in 400	1 in 500	1 in 600
5 in.	.456	.344	.288	.204	.166	.144	.137	.118
6 in.	.762	.576	.482	.341	.278	.241	.230	.197
8 in.	1.70	1.29	1.08	.765	.624	.54	.516	.441
9 in.	2.37	1.79	1.50	1.06	.868	.75	.717	.613
Slope	1 in 60	1 in 80	1 in 100	1 in 200	1 in 300	1 in 400	1 in 500	1 in 600
10 in.	2.59	2.24	2.01	1.42	1.16	1.00	.90	.82
12 in.	4.32	3.74	3.35	2.37	1.93	1.67	1.5	1.37
Slope	1 in 100	1 in 200	1 in 300	1 in 400	1 in 500	1 in 600	1 in 700	1 in 800
15 in.	6.18	4.37	3.57	3.09	2.77	2.52	2.34	2.19

Table I.

sins through roof. Attention in this connection is called to the requirements of the Chicago Ordinance prohibiting the discharge from basins being made into tile sewers within any building, furthermore, that the water discharged into a sewer shall not exceed 120° "F." It is necessary therefore to use cast iron pipe and in order to prevent leaks of joints, therefor cast iron hub and spigot pipe should be made with iron cement instead of lead—or flanged pipe used with asbestos graphite gaskets.

The following Table (II) may be of service to determine the proper size of basin to be provided:

Table II.

For Boiler of 25 to 75 H. P. use Basin 36" diameter by 42" deep.
For Boiler of 100 to 200 H. P. use Basin 42" diameter by 60" deep.
For Boiler of 250 to 400 H. P. use Basin 60" diameter by 72" deep.

For more than 400 H. P. use two or more basins—using the above as multiples according to horse power of boiler.

A ¾" or 1" cold water supply with control valve should be made to each blow-off basin and such connection will be found of service in cooling excessively hot blowoff water and help to condense steam vapors.

Downspouts and Downspout Drains:

In many localities the drainage from downspouts must be connected into a "Storm Water Sewer"—and not to the "Sanitary or house sewer." In either case arrangement of downspouts and drainage from same may be the same.

The best material to use for vertical inside downspouts is extra heavy cast iron pipe and fittings of proper size. All outside sheet metal downspouts should be connected into cast iron pipe and fittings above grade and cast iron pipe be run to proper depth below grade and connected to tile pipe by means of a cast iron quarter-bend

Before making connection to roof—downspouts should be increased one size and the roof connection should be made to allow for expansion and contraction by means of a copper or lead sleeve. Roof fittings and strainers should be of cast iron and well flashed with copper or lead.

1 sq. inch in sectional area of the leader for each 250 sq. ft. of roof surface.

Judgment must be used in arranging downspouts so as to equalize the square feet of drainage as nearly as possible.

Outside downspouts should be avoided, especially in cold climates, as they are constantly giving trouble on account of freezing and therefore cause damage to roofs and walls.

Where roofs are covered with gravel or in localities where high winds are likely to cover roof with debris, etc., the downspouts should be provided with cast iron gravel basins or running traps with cleanouts. Gravel basins or traps must always be used when connecting downspout drains to sanitary sewers, where ordinances do not require such downspout drains to be run into outside catch basin as required by the Chicago ordinance.

Size of Main House Drain:

The size of the main house drain when serving as a combination drain (sanitary and rain water) may for all practical purposes be determined by the total surface area covered by the building or buildings and paved surfaces to be drained, by the following table, which is based on cast iron pipe. If vitrified tile sewer pipe is used the diameter of pipe as given must be increased one size for same area of drainage.

Square Feet of Drainage Area.

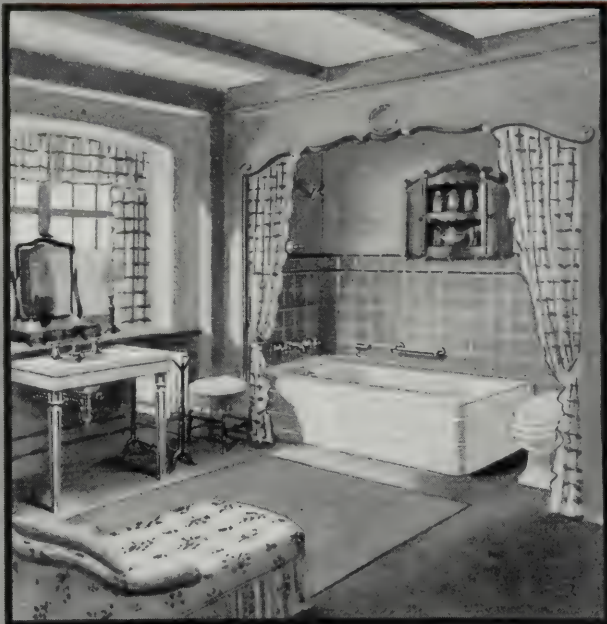
Diameter	Fall ½ in. per foot	Fall ¼ in. per foot	Fall ½ in. per foot
4 inch	1,500	1,800	2,500
6 "	3,000	5,000	7,500
8 "	6,000	9,100	13,600
10 "	9,000	14,000	20,000

Back Water Valves:

Whenever the grade or size of sewer in street is such that there is a possibility of the same backing up—the house sewer must be provided with a cast iron back water valve of approved type and this valve should be placed in a manhole or otherwise located so as to be accessible for inspection or repair. It is desirable to use a back water valve having a flushing connection so that the line may be flushed.

Where water closets or urinals are located in basements and connected to horizontal house sewers which are likely to back up during heavy rains it is advisable to place a double gate valve on the branch to such

1885 - SEVENTY-FIFTH ANNIVERSARY - 1930



How has Crane Co. gained its position as the world headquarters for plumbing appointments? The answer . . . perhaps it is to be sought in the unaffected charm of this bathroom . . . in the certainty that beauty is the inevitable complement of all Crane fixtures. Perhaps, in the fact that Crane Co. manufactures so complete a range of designs that every whim of personal taste is satisfied. But the best explanation of

the world wide acceptance of Crane plumbing materials for homes, both large and small, for offices and public buildings, for institutions, and for industries, is the unquestioned dependability of all Crane products, fixtures, valves, and fittings. Architects and builders seeking the latest ideas for laying out and equipping bathrooms, kitchens, and laundries will be interested in the information Crane Co. can give them.

Valves 

CRANE

 Fittings

FIXTURES, VALVES, FITTINGS, AND PIPING, FOR DOMESTIC AND INDUSTRIAL USE

Crane Co., General Offices: 836 S. Michigan Ave., Chicago ♦ 23 W. 44th St., New York
Branches and sales offices in one hundred and ninety-six cities

fixture in addition to the back water valve on the main drain so as to prevent sewage from backing up through these fixtures in event of the back water valve not operating properly

Flush Tanks:

Whenever the sewer in street to which connection must be made forms what is known as a "dead end" it is desirable to provide a flush tank which when filled to a proper height with clean water, will automatically discharge the contents into the sewer and thereby keep the sewer free and prevent obstructions that might otherwise occur. These flush tanks may be of two types—as illustrated herewith. Type A being suitable for flushing more than one dead end; Type B may be used if the "dead end" will be continued at some later time—in which case the flush tank may be converted into a standard manhole by taking off the cap at end of siphon and removing the latter.

Soil Pipe System:

In the order of preference for soil, waste and vent systems, we would rate: A, Brass pipe and fittings; B, cast iron pipe, calked or threaded type, with cast iron fittings; C, genuine wrought iron pipe with cast iron fittings.

The very best and most durable material for soil, waste and vent systems is full iron pipe size annealed brass pipe with red metal cast brass fittings. However, the cost of such an installation is usually greater than most owners care to invest.

Cast iron extra heavy soil pipe and fittings are the most permanent and best for soil, waste and vent systems and should be used wherever possible. While the ordinances of some cities require the use of wrought iron pipe where buildings are over seven stories in height, there is no reason why this exception should be made, as extra heavy cast iron soil pipe and fittings have been used in buildings 16-stories in height and the joints double calked as described on page 547.

The new PERMO-LOCKT hub on cast iron soil pipe, adopted as a standard by all manufacturers of cast iron soil pipe, together with the new type expansion joint, makes it possible to use cast iron pipe and fittings throughout in a building of any height with the assurance of having the best and most permanent piping system that could be installed and nothing superior to it except all brass pipe and fittings.

Threaded cast iron pipe with cast iron fittings is now being manufactured and if properly made, should prove most desirable for use where durability is a consideration.

Considering such ordinances as require the use of wrought iron pipe for soil, waste and vent systems, we would say, that unfortunately these ordinances are not specific in

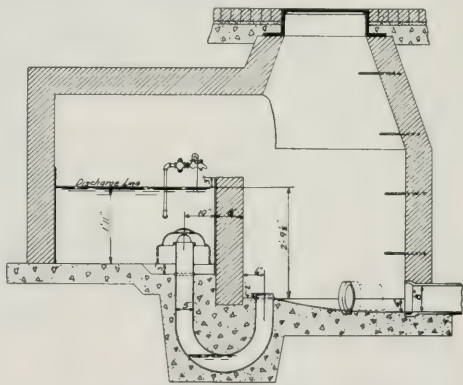
stating that when wrought iron pipe is used—it shall be Genuine Wrought Iron, hence most installations are made with commercial steel pipe, which in the opinion of the writer should never be used. In many cases where the question of cost of genuine wrought as compared to steel has been an issue—Architects and Engineers have expressed the opinion that genuine wrought pipe was not worth the difference in cost. This opinion is not shared by the writer but as stated above, I believe, that extra heavy cast iron soil pipe is the most logical material to use when all facts are taken into consideration.

If Genuine Wrought iron pipe is used for soil, waste and vent piping—all vent extensions up thru roof should be terminated with extra heavy cast iron soil pipe—the length of which should not be less than 10 feet, and more, if possible, from below roof to top of pipe.

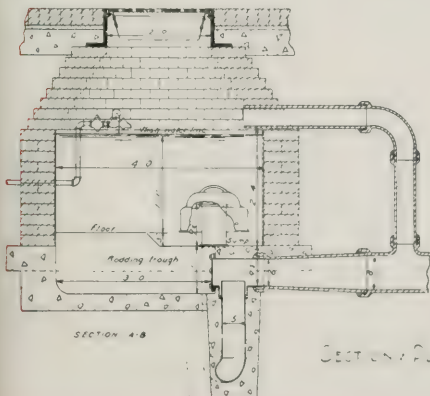
Simplicity in arrangement of soil, waste and vent stacks is desirable and it is extremely desirable to make diagrams of the system that will be of aid to the plumbing contractor as well as of being of service to the other contractors on the work. In order to be of service these diagrams must be accurately drawn and amplified by details where necessary.

The importance of a plumbing plan carefully laid out has unfortunately not been properly recognized. At the present time the cost of material is such that the Architect who is going to give his client the service for which he is paid—must more than ever consider every item that will form a part of the work.

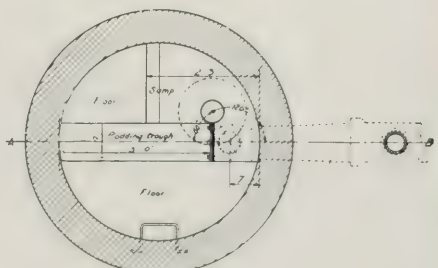
The structural parts of a building are carefully analyzed, weights of steel columns, girders, etc., proportioned to the loads they



SECTION OF FLUSH TANK TYPE "A".



SECTION "B" OF FLUSH TANK TYPE "B"



Imperial

ART CRODON

Watrous

Flush Valve



The handsome appearance of this tasteful 1929 design harmonizes admirably with the new Art Line and Colonial Style fixtures now being sold by leading manufacturers.

The design shown above is a development of our regular style flush valve, which is installed in many of the best known hotels and other buildings throughout the country.

THE IMPERIAL BRASS MANUFACTURING CO.

1232 West Harrison St.

CHICAGO

must carry, and all this work carefully detailed—and still the plumbing work is very rarely even laid out beyond a mere indication of the main run of soil or sewer lines—on the basement or foundation plan.

Specifications very often contain a clause requiring the successful bidder to submit a piping plan for the Architect's approval before commencing work. They might just as properly contain clauses asking the successful bidders to submit details for the elevations of the buildings, etc., etc. It is the Architect's duty to secure the best proposition possible for his client and therefore the plumbing work should be drawn—detailed and specified in such a manner that all bidders on the work may estimate on the same fixed basis and not permit them to submit figures based upon their ideas and conception of what may be required for the work. Such methods are very unsatisfactory and can only result in misunderstanding and most frequently in absolute failure at the expense of the client.

Whenever wrought iron pipe and cast iron drainage fittings are used, either asphalted in and out or galvanized—the stacks should be placed in pipe shafts so that the piping may be inspected and sections replaced when necessary without disturbing walls and partitions. All vents through roof should be of extra heavy cast iron soil pipe for a distance of not less than 10 feet below. Never place wrought iron pipe under basement floors. All such drainage pipe must be of extra heavy cast iron soil pipe and fittings.

When the building covers considerable area—it is desirable to use cast iron or waterproof concrete catch basins on the main lines and at intersections so as to permit of rodding the lines. In place of catch basins—large cleanouts may be used—which must always be the same size of pipe up to 6". Such cleanouts should be placed in manholes with cast iron covers large enough so that the lines can be rodded properly. Cleanouts must be placed at the foot of all stacks and wherever a change in direction of a horizontal line occurs. Cleanouts for best work should be of the heavy brass bell ferrule type with brass trap screw. With ferrules of iron the brass trap screw rusts in so that it is difficult to remove the same.

Changes in direction of horizontal lines should always be made on as full a sweep as possible, using Y-branches and 45° bends.

Connection between vertical stacks and horizontal drains in basement must always be made by means of Y-branches and 45° bends. Connection between horizontal lines on upper floors may be made by means of sanitary tees—although Y-branches are better.

All horizontal soil and waste lines should have a fall of $\frac{1}{4}$ " to the foot toward outlets where possible.

All horizontal vent lines must be pitched so that water of condensation will drain freely into soil and waste lines or stacks, and foot of all vent stacks must be connected into a main soil or waste line or stack.

Reventing of each plumbing fixture is generally required. The Chicago ordinance prescribes this; other localities permit circuit venting and hence, the Architect must necessarily familiarize himself with the requirements of ordinances that may be in force in the locality in which his building is to be erected.

All main vent stacks must be extended up through roof. On pitched roofs, the vents may extend above roof 6 to 12 inches, on flat roofs 18 inches to 2 feet will be better in order to be safe in case of heavy fall of snow and to avoid dirt entering same.

In the Eastern, Central and North Western States it is necessary to increase all vent stacks at least one size up to 6 inch before passing through roof. The minimum size

vent through roof should be 4 inch. All extensions through roof must be cast iron. Increasing stacks makes it possible to turn down lead or copper flashing into the pipe and leaves the extension free to provide for expansion and contraction. While caps or vent cowl should never be placed on top of vent stacks, it is desirable to use a strainer of cast iron of a removable type. Galvanized wire strainers are worthless. See Drawing.

Lead wastes are infrequently used in modern practice so we will only briefly mention them. When lead waste piping is used—it should be of a weight known as "medium" and when connected to wrought iron piping the connection must be made by means of extra heavy brass soldering nipples and a good heavy wiped joint. When connected to cast iron pipe—extra heavy brass bell ferrules must be used, wiped to the lead pipe and calked into the cast iron pipe.

JOINTING OF PIPE must be carefully done. For cast iron soil pipe—the following is a good method.

All joints of cast iron soil pipe shall be made with oakum and pure pig lead, bedded with hammer and calking iron. A gasket of well packed oakum shall be placed at the bottom of the hub extending above the rim of the spigot to prevent the escape of lead. The hub to be filled at one pouring and the lead calked with such force as to make the joint absolutely water tight under a pressure of at least 10 lbs. per square inch. All joints shall be filled at one pouring; if it fails to run full, it shall be dug out and repoured. Lead shall not be covered with paint, putty or otherwise.

Twelve ounces of lead should be allowed for each inch of diameter of pipe or fitting on which joint is made.

For buildings over six stories in height the cast iron soil pipe joints shall be double calked in the following manner: The oakum shall be well braided and before being placed in position shall be oiled and then well calked; then fill in the hub to within $\frac{3}{4}$ " of the top with molten soft pure lead and thoroughly calk. After the lead has been uniformly calked, fill in with molten lead to the top of hub and thoroughly calk—so as to make an absolutely perfect joint. All joints showing leaks under testing shall be dug out, repoured and double calked as above.

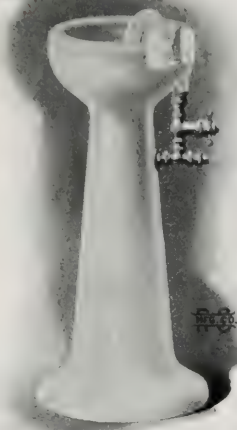
With cast iron pipe double calked as above, installations have been made in buildings 16 stories in height in which the entire system is still in excellent condition after a period of 27 years.

Joints between lead and cast iron pipe to be made by means of brass ferrules wiped to the lead pipe and calked into hub of cast iron fittings. Joints between lead and wrought iron pipe to be made by means of soldering nipples with hexagon nuts. Joints between wrought iron pipe and fittings to be screwed home into couplings or fittings without the use of any red lead or other compound.

No steam or cast bushed fittings to be used on any drainage or vent work.

Joints of tile pipe shall be made with neat Portland cement. A cleaner to be run through every length of pipe as it is laid so that no mortar used in jointing will adhere to the interior of the pipe. The connection between cast iron and tile pipe shall be made with a collar of concrete 6 inches thick and extending not less than 8 inches on each side of joint. See illustration.

All soil, waste and vent piping shall be tested. Ordinances usually prescribe the manner of testing which may be by means of water, air, peppermint or smoke on new work.



R-S Seat Operating Closets

Especially designed for schools, public buildings, hotels and industrial plants. The R-S Seat Operating Closet maintains greater cleanliness and requires less repairs than any closet outfit you can get at any price.

R-S Vertico-Slant Fountains

Sanitation, particularly *drinking* sanitation is a most important consideration in every building where many people gather. R-S Vertico-Slant Fountains are preferred by architects because they measure up to the most rigid standards of drinking sanitation.

Lips can't touch the R-S nozzle. The slight slant stream prevents water from falling back upon the jet. No places where germs can hide. Everyone may drink without danger of contamination by means of lip-contact.

R-S Vertico-Slant Fountains come in a variety of models—designed for every requirement in schools, hotels, hospitals, industrial plants and all public buildings.

Write for catalog with complete information on R-S Sanitary Drinking Fountains, Plumbing Fixtures and Supplies.



RUNDLE-SPENCE MFG. CO.

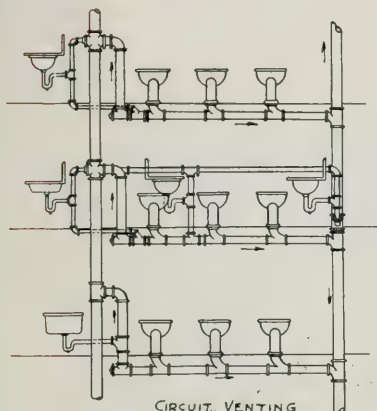
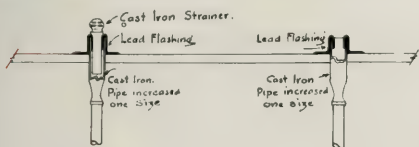
55 Fourth St., Milwaukee, Wis.

The following illustrations show several methods for reventing plumbing fixtures in accordance with the Chicago practice and also by what is known as the "Circuit Venting" system.

THE WATER SUPPLY

There are so many failures in the water supply system of buildings that it is evident that little study is given the problem which is one of most vital importance.

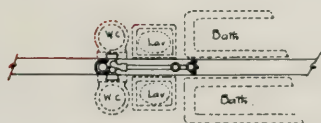
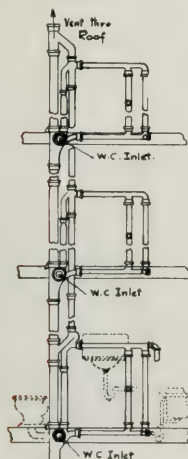
In order to provide an adequate supply of water for the particular building it is necessary to analyze the actual requirements based on a per capita consumption per day—and another factor that enters into the problem is the pressure under which the water will be delivered.



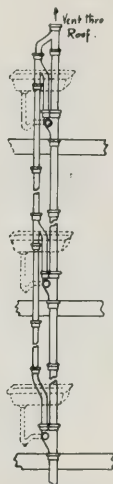
Circuit Venting.
Wrought Iron Pipe & Drainage Fittings.

For good work both water and peppermint tests should be made and if it is desired to be absolutely certain that integrant traps of water closets, etc., are perfect a smoke test may be made after fixtures are set.

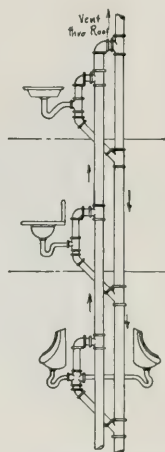
In alteration work a peppermint test must always be made.



BATH ROOMS (DOUBLE) ON ONE
STACK—USING F&W C.I. FITTINGS.



SINK STACK, USING F&W.
CAST IRON FITTINGS.

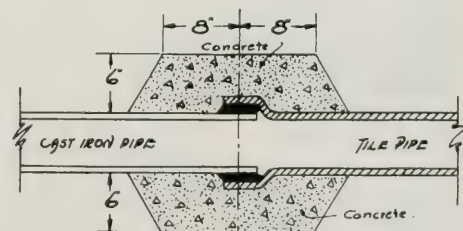


W.I. PIPE & DRAINAGE FITTINGS.

Per capita requirements may be determined by the following tables, which are the minimum:

Schools (not boarding) 50 gallons per capita per day.

Industrial Plants & Factory Buildings—50 gallons per capita per day.



METHOD FOR JOINTING C.I. to TILE PIPE

This does not include water that may be required directly in connection with plant operation in various manufacturing processes.

Hotels, Hospitals, Asylums, Sanitariums—150 to 200 gallons per capita per day.

Homes for the Aged, Orphan Asylums, Boarding Schools—Dormitories—100 gallons per capita per day.

To the above must be added water for sprinkling lawns, etc. which must be based on the flow in gallons per minute of each $\frac{3}{4}$ " lawn sprinkler installed—allowing for a

The Seat of Permanent Service

FOR HOMES AND BUILDINGS OF EVERY DESCRIPTION



CONSTRUCTION
OF THE BRUNSWICK
WHALE-BONE-ITE
CLOSET SEAT

- D—Concealed hinge plate extends across seat, inside the core
- C—Outer covering baked on and polished to a glossy, lasting finish
- B—Two sections of laminated core runs LENGTHWISE the seat
- A—Counter sections of laminated core run CROSSWISE the seat



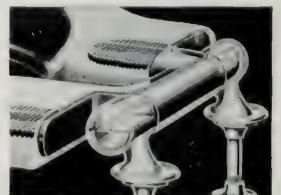
Showing Integral
Moulded Hinge

Within the past decade Brunswick Whale - Bone - It Closet Seats have been chosen by architects everywhere as sanitary units in buildings where plumbing installations demand permanent beauty and lasting strength.

Absolutely impervious to the action of water, acids, cleansers and germs, the Whale-Bon-It Closet Seat functions

for years—guaranteed against corroding, cracking, chipping, crazing or warping. It is built to last!

A new feature of this sanitary unit is the Integral Moulded Hinge, pictured to the left. This hinge, reinforced with a metal die casting in one piece and covered with highly polished Whale - Bone - It is literally part of the seat itself!



Seat and Hinge Form
Unbreakable Unit

Manufactured by

THE BRUNSWICK-BALKE-COLLENDER CO.

and sold by leading plumbers and jobbers everywhere, as well as at Brunswick Branch Offices in the principal cities of the United States and Canada

General Offices: 623 SOUTH WABASH AVENUE CHICAGO

period of 3 to 4 hours for each sprinkler as a fair average.

Having determined the total quantity required for 24 hours—the next thing to determine is the proper pressure required for the work and in working this out the following must be considered:

The following tables may be used to advantage in determining the sizes of main and branch supplies for buildings:

Equalizing Table of Areas of Taps

PIPE SIZES, INCHES	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5
1/2	1	1.7	2.8	4.9	6.6	11.	15.6	24.	32.	65.
3/4		1.	1.6	2.6	3.8	6.2	8.9	13.8	23.	37.
1			1.	1.7	2.3	3.8	5.5	8.5	14.	23.
1 1/4				1.	1.3	2.2	3.1	4.9	8.	13.
1 1/2					1.	1.6	2.3	3.6	6.2	9.7
2						1	1.4	2.2	3.8	5.3
2 1/2							1.	1.3	2.6	4.1
3								1.	1.7	2.7
4									1	1.6
5										1

Equalizing Table of Delivering Capacities of Pipes

DIAMETER, INCHES	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6
1/2	2.27	4.88	8.49	15.8	31.7	52.9	96.9	205	377.	620
3/4		2.05	3.43	6.97	14.0	23.3	42.5	90.4	166.	275.
1			1.62	3.45	6.82	11.4	20.9	44.1	81.1	133.
1 1/4				1.69	2.67	5.94	11.6	23.7	47.4	78.5
1 1/2					1.26	3.34	6.13	13.0	23.8	39.2
2						1.67	3.06	6.47	11.9	19.6
2 1/2							1.83	3.87	7.12	11.7
3								2.12	3.89	6.39
4									1.84	3.02
5										1.65

Gallons per Minute Delivered From Circular Openings at Mains Under Various Net Pressures

HEAD, IN FEET	Pounds Pressure	DIAMETER OF OPENING, INCHES								
		¼	⅜	½	⅝	¾	1	1¼	1½	2
10	4.33					33	56	91	131	224
20	8.66	5	12	21	32	46	82	123	185	328
30	13.09					57	101	158	226	404
40	17.32	7 5	16	30	46	66	112	182	262	466
50	21.65					73	130	206	299	520
60	25.95	9	20	36	58	80	143	223	329	572
70	30.28					85	154	239	348	616
80	34.65	10	23	41	64	92	164	258	370	656
90	38.98					97	173	271	391	692
100	43.31	11.	26	46	72	104	184	288	415	736
110	47.64					109	192	300	432	768
120	51.98	13.	28	50	79	114	202	316	454	808
130	56.31					118	209	325	471	836
140	60.61	13.5	31	55	81	122	217	336	491	868
150	64.97	14.	32	57	87	126	226	353	509	901

Where the water supply from City mains cannot be relied upon as sufficient in volume or pressure to supply all fixtures in the building it will be necessary to provide for reserve storage to insure a constant supply, and there are two kinds of systems to be considered—First the one most commonly known, a tank on the roof, and the other and more recent—a compression tank system with a closed pressure tank in the basement. The roof tank system is obsolete and not recommended—for the reason that in order to maintain a pressure of 20 lbs. on the top floor it would have to be elevated 50 feet above the floor to give this result. Furthermore such tanks require special provision to be made for their support, must be enclosed and generally considered from a standpoint of efficiency vs. expenditure, are out of question at the present time.

The best system is a compression tank pumping system—which we shall briefly describe. These systems may be divided in two kinds—one where the pressure of the water is so low that all must be pumped and the other where it is only necessary to increase the pressure for the upper floors—in which case the system is known as the “booster” type.

In the first type the water may be delivered from a well, cistern or city main and

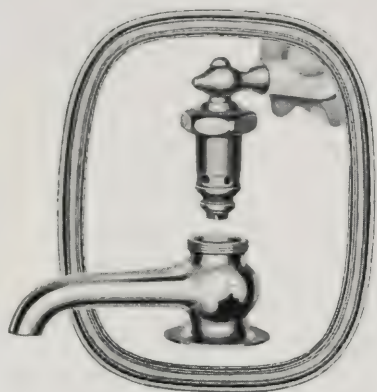
If the average pressure is not sufficient to deliver water on the top floor of the building under at least 20 lbs. maintained pressure, it is advisable to provide a pumping system to increase the pressure so as to maintain an average of at least 20 lbs., on the top floor.

depending upon the source of supply a pump designed for that special work must be used. Wherever possible, when pump is within suction lift of the water (20 feet) a centrifugal or turbine type pump with direct connected motor is the best to use. These pumps are of greater efficiency, less noisy and are more economical in operation than piston pumps.

In order to determine the proper size of pump to install we refer to the following table—which should be checked up with the per capita allowance per day previously mentioned.

To apply the above—First ascertain the number of fixtures pump is to supply—be sure to include every kind of fixture. In case any fixtures are supplied direct from city main these should be deducted. Second—Multiply the number of fixtures by the proper decimal that may apply according to the class of building.

Stores & Shops.....	.75
Office Buildings.....	.75
Factories.....	1.00
Apartment Buildings.....	.5
Hotels.....	.8
Hospitals.....	1.00
Schools.....	.8



Leaking faucets and burned-out bulbs

WHENEVER a faucet starts leaking, a **MAJOR OPERATION** is required to stop it. When an electric bulb burns out, anyone can tend to that.

The main reason why building managers and engineers and home owners appreciate Chicago Faucets is because anybody can repair a leak in a minute or two. Chicago Faucets have a standardized working unit that fits every faucet. It is almost as easy to remove this and substitute a fresh one as it is to replace a burned out bulb in a light socket. There are only two wearing parts—seat and washer—and both are easily replaceable at a cost of a few cents.

No Chicago Faucet will ever

wear out. The washer may need changing after several years wear. The seat itself may be renewed after a longer period. But the fixture itself will last as long as the building.

Chicago Faucets are being used to replace all other types in thousands of buildings, and no further replacement is ever necessary.

We shall be glad to furnish you with a list of such buildings so you can investigate these unusual claims.

Let us send you our catalog and a cut-out sample of a Chicago Faucet showing this everlasting unit construction.

THE CHICAGO FAUCET COMPANY

2700-22 N. Crawford Ave., Chicago, Ill.

CHICAGO FAUCETS

The table is based upon an equal number of males and females and the figures represent the gallons per minute per fixture. If the major portion of occupants are females increase pump capacity 25 per cent.

Where more than 150 fixtures are to be supplied pump capacity may be reduced 15 to 25 per cent.

Where actual water requirements have been determined (by meter or otherwise) furnish a pumping unit capable of discharging three times the actual quantity used.

Example—The total number of fixtures to be supplied by pump in an office building is 120. $=120 \times .75 = 90$. Therefore 90 gallons per minute which pump must discharge. Now to determine the head—The water must be elevated 100 feet and develop a pressure of 20 lbs. The actual head therefore will be 150 feet and to this must be added the distance of suction lift, if any, and allowance for loss of head by friction in pipe. If suction lift is 20 feet—this added to 150 makes a total of 170 and allowance for friction, 10 per cent, makes a total head of 187 feet against which the pump would have to work. The problem worked out in this manner and reference to standard catalogues of pump manufacturers will enable anyone to select the proper equipment.

When the system is of the second type or "booster" system—the head against which pump will work is determined by the following method:

Pump location to highest fixture...	100 feet
Range from minimum to maximum pressure	100 "
	200 "
Deduct City pressure 25 lbs. in feet	
—60	60 "

Pump required for a total head of..140 feet

Compression tanks should be installed of such size that the cycles of pump operation do not exceed three to four per hour. To insure this condition the tank should have a storage capacity of 25 to 30 times the capacity of pump per minute. To illustrate for a pump of 90 gallons per minute:— $30 \times 90 = 30 \times 90 = 2700$ gallons per tank— $1/3$ to $1/2$ of the storage capacity of tank should be filled with air—at maximum working pressure.

Where the city pressure is not constant and less than 20 pounds, it is advisable to install a surge tank to which the suction end of the pump is connected. The suction line to be provided with a gate valve and two horizontal check valves. The supply to the tank should not be less than 2" and the supply controlled by a float valve of approved type. The storage capacity of the surge tank should be at least ten times greater than the delivery capacity of the pump in gallons per minute.

The surge tank may be of cypress or steel and provided with a removable cover and also a 2" drain connection or larger, valved and connected to sewer.

Where the city water pressure exceeds 20 pounds and is constant, the surge tank may be omitted if the pump is of the centrifugal or turbine type, and the suction pipe may then be connected to the main service direct. However, in this case, the cross sectional area of the main service pipe must be at least 50 per cent greater than the area of the suction pipe of the pump.

Suction pipe connections must be provided with two check valves and a gate valve.

For large installations duplicate pumps should be installed.

Service Connection to Building:

For water service connection to buildings under 2" in size extra strong lead pipe may be used with corporation stops and goose-necks as required by regulations of the Water Department.

It is now possible to obtain cast iron pipe,

$1\frac{1}{4}$ ", $1\frac{1}{2}$ " and 2" diameter, which is made in 5-foot lengths, hub and spigot pattern or threaded and the use of either one is highly recommended for service connections instead of lead pipe. Wrought iron or steel pipe should never be used for service connections under ground.

For service connections of larger diameter than 2" cast iron water pipe in 12-foot lengths, hub and spigot pattern of proper class or weight to suit pressure should be used.

When cast iron pipe is brought into the building and up through floor, the same should terminate in a flanged end fitting about 12" above floor.

Heavy pattern stop cocks or gate valves provided with heavy tee handle operating rods should be placed on the service connection and provided with cast iron service boxes with cast iron covers. On the inside of the building the main service must be provided with gate valves and arranged for meter connection if required by the Water Department. Provision must be made for supply connections inside fire standpipes as may be required.

From this point on the supply piping should be of the following material:

Water Supply Piping:

1. Red brass pipe, iron pipe size, properly annealed seamless tubing with red metal cast brass fittings for such work where the utmost durability is desired.

In some cases where it may be desired to effect some saving in cost, the hot water supply and return piping are specified to be of red brass and the cold water supply piping of genuine wrought iron pipe galvanized.

It is suggested that all specifications for work of the best class be drawn covering red brass pipe for the water supply lines, both cold and hot, or at least for the hot water supply and return lines, and then, if desired, an alternate bid may be asked for on the supply piping of genuine wrought iron pipe with galvanized malleable iron beaded fittings.

This will enable the Architect to take advantage of a reduction in cost if the owner desires to make such a saving, and the Architect cannot be criticized for not having specified the best material for the work.

2. Next to red brass pipe the best material to use is genuine wrought iron pipe galvanized.

3. Where cost is the sole consideration and durability of not vital importance, commercial steel pipe, galvanized, may be used.

The following suggestion is made to specification writers on the subject of Genuine Wrought Iron and Steel Pipe.

Most frequently the specification states that the supply piping shall be of wrought iron pipe and this is the cause of much misunderstanding and frequently the installation of material that is not wanted.

When the phrase, "wrought iron pipe," is used, it is commonly taken for granted by plumbing contractors that the grade of pipe known as "Commercial Steel Pipe," either black or galvanized, will be satisfactory. Perhaps in many cases it will be, but it frequently happens that the Architect intended that genuine wrought iron pipe was to be used. In order to clarify this matter it is suggested that the specifications designate whether the pipe throughout shall be genuine, wrought iron or commercial steel pipe. In case of the former, the words should be added "with the name of the manufacturer stamped on each length."

Flanges and Unions:

All pipe up to $2\frac{1}{2}$ " should be provided with galvanized malleable iron unions with brass seats and all pipe over $2\frac{1}{2}$ " to be provided with flanged unions having gaskets of asbestos graphite packing $\frac{1}{8}$ " thick for best work and rainbow packing for average work.

Valves and Stops:

Valves should be heavy type brass double



Fig. D-101

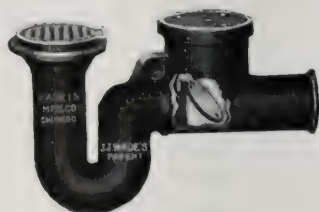


Fig. D-402

The problem of eliminating back water, with its accompanying nuisance of flooded basements, is easily solved by the use of WADE back water valve drainage fittings. Accessibility, simplicity, reliability, and durability are paramount features of these drains.



Fig. D-378



Fig. D-380

WADE "Accessible" floor drain basins intercept all accumulated floor wastes instead of allowing such debris to enter the sewer lines direct where stoppage soon occurs. These floor drain basins are recommended for all concrete floors where a drain of any type is needed.



Fig. D-452

The new, improved WADE "Accessible" down-spout head offers features radical in roof drain design. The WADE Drain is non-caulking, non-threading, is self-expanding, and the new adjustable clamp ring firmly secures the roofing material to the drain, making it absolutely rainproof.

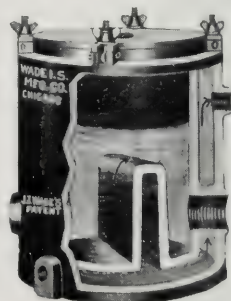


Fig. D-220

The WADE water jacket grease trap affords constant water circulation, and gives the greatest cooling area for congealing grease. By actual test this trap loses less than 1% of grease entering it.

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gate valves up to 2½" and iron body bronze mounted flanged end for larger sizes. Valves should be of the "rising stem" type for the reason that with this type it can be quickly observed if the valve is "open" or "closed."

Globe valves of approved pattern with heavy brass body and soft rubber discs for cold water lines and composition discs for hot water lines may be used instead of gate valves on pipe from ½" to 1½". For larger pipe, gate valves should be used.

Fittings and Nipples:

Fittings for genuine wrought iron or steel water supply piping should be galvanized malleable iron beaded fittings. Plain fittings must never be used. If the pressure exceeds 75 pounds, extra heavy fittings should be used.

Nipples whether on genuine wrought iron or commercial steel pipe lines should in all cases be of genuine wrought iron. The nipple is the weakest part of any line, and for the very best work, nipples known as close or short pattern should be made of "extra strong" pipe. Genuine wrought iron nipples so stamped may now be obtained from manufacturers and makes it possible for the superintendent to assure himself that the contractor is furnishing the proper article.

THE HOT WATER SUPPLY for the building should be determined upon the actual requirements to suit the conditions of each case.

For instance—in the case of a hotel with 100 bath rooms—each containing lavatory and bath tub or shower—the demand for hot water is at a peak load—from 6:30 to 8:00 A. M. and 4:30 to 7:00 P. M. with lesser demands at noon and later at night.

To provide for such service a minimum of 30 to 40 gallons should be allowed for each bath room per hour—this with 100 rooms would mean a heater having a capacity of 3000 to 4000 gallons per hour to which must be added the quantity that will be required for kitchens, laundry, etc.

Generally speaking the following table may be used to determine size of hot water supply systems:

Schools (not boarding):

- 5—gallons per pupil per day for water used in lavatories,
- 6—gallons per minute for each shower or
- 25—gallons for each pupil using the shower.

Hospital:

- 50—gallons per day for each person and add 50% of total for kitchen—laundry and general service.

Hotels:

- 50—gallons per day for each bath room and add 50% of total for general service.

If there is a Turkish bath in connection with the hotel add 100 gallons for each bather—based upon the capacity per hour of the establishment.

Apartments: Allow 100 gallons per day for each apartment having not more than 2 baths, for each additional bath add 25 gallons and 25% of the total for general service.

Factories: Allow 10 gallons for each employee per day for each wash basin and 25 gallons for each employee using showers.

Boarding Schools—Asylums—Homes, etc.: Allow 40 gallons per day for each person. For showers 25 gallons for each user and add 50% of the total for general service.

For smaller installations a hot water storage tank with steam coils for winter service and hot water heater for summer service makes a satisfactory installation. The tank should always be provided with a thermostatic control to prevent overheating the water. Tanks with coils should always have a manhole at one end.

In cases where the heating system is a vapor system, the water should be heated

by means of a hot water heater the year around, as the pressure of the steam is too low to effectively heat the water by means of steam coils in the tank.

Where showers are used it is desirable to place a thermostatic hot water line control valve in the hot water supply main in order to prevent scalding. It is good practice to separate the system in Hotels, Hospitals, etc., so that the water supplied to bath tubs, lavatories and showers is controlled in this manner. It not only prevents possible scalding but saves fuel and increases the life of valves, faucets, etc., which excessively hot water materially shortens.

In larger installations—especially where both exhaust and live steam (high or low pressure) are available; the hot water system should be arranged in two units; the first a storage tank of proper size, called the primary heater, in which the water is heated by exhaust steam—from this heater it passes to the secondary heater which is provided with coils supplied by live steam under thermostatic control. The latter heater brings the water up to the desired degree of temperature at which the control is set.

Another and most economical type of heater is the instantaneous type—heated by low or high pressure—controlled by an automatic thermostatic device and using only such quantity of steam as necessary to heat the water actually used—to the temperature for which the control is set. This type of heater is very efficient and economical and is especially adapted to large installations as Hotels, Hospitals, Factories and wherever there may be a large variation in the demand for hot water throughout the day or night.

In order to ensure proper results, hot water systems must be in perfect circulation—wherever possible the overhead type system should be used with a riser to the top floor—horizontal supply mains and drop supplies to the fixtures on floors below with circulating return in basement. Hot water riser should have an air vent trap at highest point.

Pressure of hot and cold water systems should always be the same.

In some cases circulating pumps are necessary. These should always be of the centrifugal type with low speed motors and if direct current is available, motors should be provided with a variable speed control.

In conclusion of the suggestions for water supply system—I would say that in my experience most mistakes have been made in having the piping system too small and this is especially true in the case of hot water tanks and heaters.

A heater too small for the service will waste more fuel than one too large.

ARRANGEMENT OF TOILET ROOMS AND PLUMBING FIXTURES.

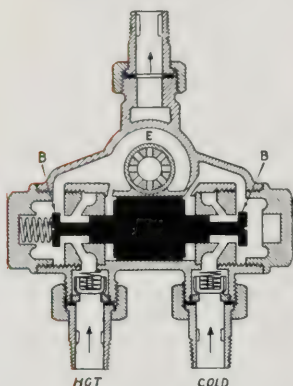
Few Architects realize how much the cost of the plumbing and heating on a building is governed by the design and location of toilet rooms. Many buildings are up several stories before the location of pipe chases or shafts are decided upon and many botched up piping jobs are the result of this neglect.

This again brings up the great need of proper plumbing plans and diagrams—showing the proper size and location of the piping and permitting the general contractor to provide chases in walls—leave openings in floors and provide pipe shafts of proper size for the work.

In residences with wood studs the partition carrying soil pipe must have at least 6" studs and a still better arrangement is to have a hollow space and use 4 or 6" studs flat wise and framed once or twice in their height as this saves cutting of studs for horizontal vent pipes.

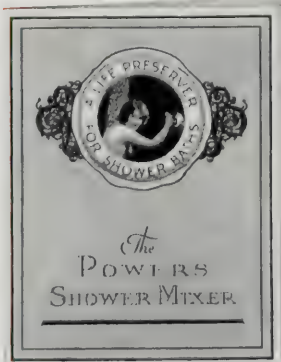
If partitions are hollow tile, 6" thick tile should be used. Thin partitions of gypsum materials make very unsatisfactory parti-

THE POWERS SHOWER MIXER



Pressure Equalizing Valve
Shown above in black

This valve is a floating piston which controls and equalizes the pressures of Hot and Cold Water before they enter the mixing chamber. Prevents changes in temperature of shower caused by fluctuating pressures in supply lines due to the use of nearby plumbing fixtures. Hot Water is substantially shut off if Cold Water fails.



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Our 20 page book contains roughing in dimensions, specification data, shows results of tests and names of hundreds of users.



Safety. This mixer is equipped with a *Pressure Equalizing Valve* described at the left, a feature found in no other mixer. Also has a Safety Stop which limits delivery temperature of water to a predetermined point. These two features eliminate unexpected "Shots" of Cold and scalding Hot Water.

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Economy. Powers Mixers save water and prevent steamed-up-bathrooms, which loosen paint and plaster. They also reduce repair expense, as there are no composition valve seat washers on Hot Water inlet to be frequently replaced.

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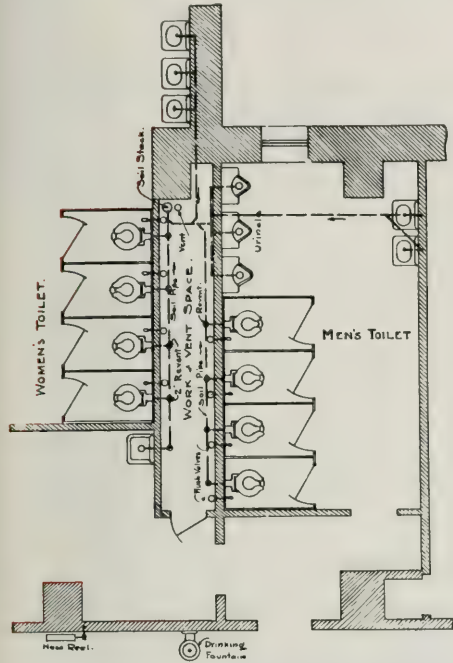
tions for concealment of piping, as no secure anchorage can be had in same for bolts to fasten hangers or brackets for fixtures; furthermore, condensation on pipes dissolves sulphuric acid in gypsum and induces quick corrosion of metal.

With buildings of fireproof construction in which the floors are of reinforced concrete

is always desirable to tile around the top of tub, as this makes a more permanent installation than a finish of hard plaster.

Shower stalls should never be less than 3'-0" x 3'-0" inside for a comfortable stall. 3'-2" x 3'-2" is the standard size adopted by plumbing manufacturers and should be used wherever possible. Stalls should be at least 6'-6" high. Solid porcelain receptors, grooved to receive marble partitions are the best and are absolutely leakproof. If marble floor slabs are used they must not be less than 2" thick and should be grooved all around to receive marble partitions.

The placing of sheet lead flashing underneath marble shower slab or tile for shower stalls on upper floors has been discontinued for the reason that very often the weight of the stall above same cracked the sheet lead



TOILET ROOMS WITH WORK-VENT SPACE BETWEEN SAME.

the location of bath and toilet rooms must receive careful study.

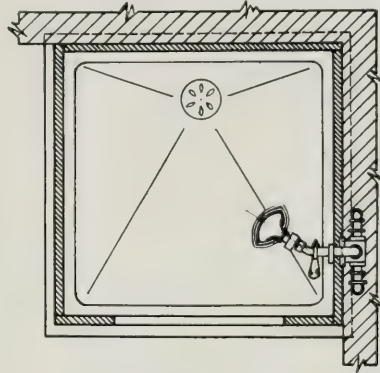
There are three schemes that may be used. The first, a pipe shaft 2'-6" to 3' in width extending up through the building—in which all piping may be placed and fixtures all provided with wastes and supply connections to wall. (See illustration.) This arrangement is very desirable for Hospitals, Schools, Hotels, Office Buildings, etc.; it makes an ideal arrangement and is economical in cost of installation and maintenance. All pipe being exposed it is easily gotten at in case of repairs.

The second is to raise the floor of toilet rooms 7" to allow for piping being concealed in floor. This is sometimes objectionable and in the case of Hospitals, Homes and Institutions should not be done.

The third is to run the piping under the ceiling of room below—either exposed or concealing the same by furring down the ceiling.

In planning toilet rooms it is most important to ascertain the exact size of the various fixtures that are to be installed—so that these will be placed properly and to the best possible advantage.

This is especially necessary in the case of bath tubs and shower stalls. If recessed tubs are used, the exact length overall, distance the ends and back will extend into wall must be considered as there is always a difference between the nominal size of bath tub and their actual overall length, the end at which the waste and supply fixtures are to come should be shown and a paneled door of proper size provided so that the fittings can be properly installed and accessible in case of repairs. When recess tubs are used—it



PLAN



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so that the installation of same as a means to prevent leaks—was a useless expense.

The best material to use for water proofing under marble or tile shower slabs is to build up three or four thicknesses of genuine asphalted felt well lapped and swabbed with asphaltum and the edges of the felt turned up at least 6" high at side walls. This is an inexpensive method and far more satisfactory than sheet lead.

A word of caution in connection with the kind of material to be used for shower stalls. Marble, slate, vitreous tile and salt-glazed brick are recommended as suitable, but the use of steel for shower stalls whether galvanized or painted is not recommended for the reason that it is not durable and its corrosion is only a question of time.

It is desirable to place the controlling valves to shower head on one side of the stall near the entrance (see adjoining illustration), so as to permit the water being turned on and tempered without wetting the bather. When a stop valve is placed in the supply to the shower head, it will be necessary to provide the hot and cold water supplies with check valves to prevent the bypass of water from either side in event that the valves on inlet of shower are not entirely closed. When there is no valve between the inlet valves and the shower head, check valves are not absolutely necessary.

All shower heads should be placed 6 feet above floor for adults and 5' 6" for school showers provided with an adjustable ball joint by means of which the angle of the shower head may be changed as desired. Shower heads arranged in this manner give better results and will not wet the bather's head unless he so desires.

When thermostatic or anti-scalding shower valves are used, it is always desirable to place on the hot and cold water supply line for each, a loose key compression shut off by means of which the supply can be controlled, which is necessary if the pressure is very high or the pressures of hot and cold water are not equal.

When plain compression type control valves for showers are used in place of thermostatic or anti-scalding valves—a thermostatic hot water control valve should be placed on the hot water supply line to the showers and set so as to prevent the hot water exceeding 110° F. in temperature.

The placing of plumbing fixtures against outside walls should be avoided. It is very unsatisfactory. Even if the supplies are carefully covered there is always danger of freezing. The custom of placing bath tubs under outside windows is most objectionable. This has been commonly done in apartment house work. A little study of grouping would have produced better results.

In public toilet rooms the arrangement of water closet stalls must be well considered. Where a number of these are to be installed the size of the stalls must be determined. The adopted standard width is 2'-6" centers for schools—they should not be less—but

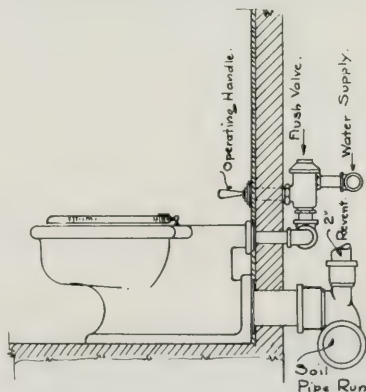
may be more. For adults the stalls should be 2'-10". Three (3) feet is the greatest width that should be used. To make them wider would be waste of space. The depth inside should not be less than 4'-6" with doors swinging in. This depth will allow the standard width—2 foot door to well clear the front of the closet bowl.

In factory, etc., and school work, especially primary grades, it is better to omit doors entirely and in this case the stalls need not be more than 3 feet, or at the most 3'-6" in depth.

If possible all flush tanks, piping, etc., should be concealed in a work space in rear of closet stalls. The wall of work space being formed by the backs of partitions or a built up wall as desired. Frequently this same work space is also utilized as a vent space, providing the back of each stall with a vent opening, protected by a ventilating hood or register face. This makes a most desirable arrangement for ventilating large toilet rooms—especially adapted for schools, asylums and all public toilet rooms.

The water closet stalls may be of marble, slate or steel according to the class of work. Steel partitions are very satisfactory and excellent for school and factory work.

The bottom of all partitions should be 12 inches above the floor. When marble is used the pilasters should be 1½ or 2 inches thick and grooved to receive the partitions. The backs should be cut out to receive the partitions and a top rail of marble corresponding in thickness to the pilasters and 3½ or 4" high extend along the entire front. The bottom of rail should not be less than 6'-6" high for schools and 7 feet for public toilet rooms. This arrangement does away entirely with brass floor and top standards and



WATER CLOSET: WALL OUTLET.

all metal angles—very desirable for the reason that nickel plated brass work becomes tarnished very quickly and is rarely given the care it requires to keep the same in good condition.

If wood doors are used they should preferably be of the type known as "sanitary", perfectly flush without panels. The standard



N. C. T. Vitreolite Dispenser



Norfold Vitreolite Towel Cabinet

For the Modern Building

NORTHERN Towel and Tissue Cabinets are made from quality steel with a durable finish. They have no mechanical parts to get out of order. Towel Cabinets work on the gravity feed principle. Tissue dispensers have a strong spring guaranteed for life.

The Norfold Cabinet is made in two styles, the drawn steel design, with rounded corners is finished in baked on Vitreolite white enamel or enameled gunmetal green. The built up type with square corners is finished in white enamel and gunmetal green.

The strong Northern Towel Cabinet for standard fold towels comes in white enamel and gunmetal green.

The Northern Cabinet Tissue Vitreolite dispenser, shown above is finished in a lustrous baked on Vitreolite white enamel or in non-tarnishing chromium plate.

The standard Northern Cabinet Tissue dispenser with the square corners is finished in gunmetal green or white enamel.

These dispensers will be in keeping with the finest buildings. They are economical in operation and moderate in first cost.

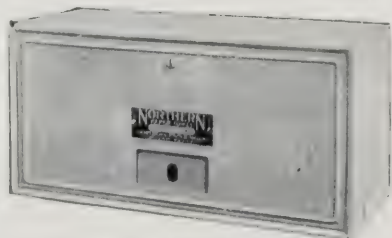
Ask for samples and prices.

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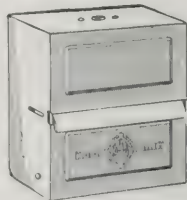
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Standard Towel Cabinet



Gunmetal N. C. T.
Fixture

size is 2 feet wide, 5 feet high and 1½" thick. They should be provided with an adjustable N. P. box spring hinge and blank with check, door latches and stops and should always swing in, with spring set to hold the door open when not in use.

While on the subject of water closet stalls a word of caution regarding the floor is apropos. It frequently happens, especially in school and factory work, that the floors of toilet rooms are pitched toward a floor drain and whenever this is done the contractor doing the flooring work should be cautioned to keep that portion of the floor on which the water closets are to set perfectly level and establish his break line at least 3 inches forward of the front of the base of the water closet bowls. Unless this is done the plumber when setting the bowls will level them up with cement in order to obtain an even bearing and the cement under the base of the bowls either causes them to crack on account of unequal expansion and contraction or because of improper support throughout the entire base, the unequal strain on the ware will cause cracks.

For connecting water closets with floor outlets to soil pipe or fittings only cast iron bends of an approved type should be used—with a gasket of asbestos, graphited.

Connection between waste outlets of water closets with wall outlets and soil pipe should be made by means of heavy combination lead and iron ferrules, one end caulked into hub of cast iron fitting, the other wiped to a brass closet flange and asbestos graphite gasket.

This method of connection does not cover the wall hung type closets now being used of which each special type is provided with a special designed form of attachment to the soil pipe or stack.

Now as to the type of water closets to be used. There are today practically only two styles—one known as a siphon jet bowl, the other a washdown with jet. There are of course a large number of various special type bowls in the market but they are modifications of the above types.

The siphon jet bowl is the best to use on account of its more quiet action in flushing and also for the reason that the interior of the bowl presents less fouling surface, owing to the larger water surface.

The greater the cross-sectional area of the siphon limb the better the operation of the bowl. The minimum diameter of the siphon limb should be 2½" and 3" is better. The more uniform the passage is the less danger of stoppage. **All bowls should be tested out under water before shipment by the manufacturer—for two reasons: one to determine whether the ware is free from cracks—called "dunts" by the potteries, the other to be certain that the construction of the bowl is perfect.**

In many localities the water contains incrusting ingredients that may cause clogging up of the jet tubes in time. Such conditions may be remedied by emptying the water contained in the bowl and pouring a pint or more of "Commercial" Muriatic acid into the bowl. The acid will dissolve the solids in

the jet opening in about ½ to ¾ of an hour.

However, where the water is extremely bad—it is advisable to use the washdown type of bowl with jet, which is not as apt to become stopped up as the jet openings are larger than in the siphon jet type and the tube has no pocket in which deposits can accumulate.

Where it is necessary to practice economy in the selection of fixtures—it is advisable to use washdown water closets with jets. For Schools and Factories this style is generally used.

There is another type of closet used today which is a composite of the siphon jet and washdown bowls. This bowl is known as the "reversed trap type" and when correctly designed and properly made, makes a very satisfactory closet. It has less fouling surface than the washdown bowl and is siphonic in action.

The conditions that are to be met in each case must necessarily determine the particular kind of closet that should be used. Also whether the bowls should have extended lips, floor or wall outlets, have low down tank, or flush valves or flushed automatically by seat operating valves. No fixed rule may be prescribed for such selection, which can only be made according to requirements of the work itself.

In the selection of water closets consideration must be given as to the manner in which the closets are to be flushed. Water closets with high tanks or low down tanks require a ½" supply connection, whereas these fixtures if operated by means of flush valves—require 1 to 1¼" supply connections to each flush valve. Water closets with automatic seat operating valves require ½" supply connections as a rule.

Where there is more than one water closet in a row or battery, the main supplies for such battery must be of a size that will adequately supply all fixtures. Reference to the following table will be of service:

Table of Branch Supplies for Water Closets.

The following table will be of service to determine the proper size of branch supplies for water closets from 1 to 12 fixtures in a battery. The size of pipe is based on a pressure of from 20 to 40 pounds.

For Automatic Seat Operating Water Closets or Water Closets with Low-Down or High Tanks. Inlets ½".

Number of Closets	Size of Branch, Inches
1	¾
2	¾
3	1
4	1
5	1¼
6	1¼
7	1½
8	1½
9	1½
10	1½
11	2
12	2

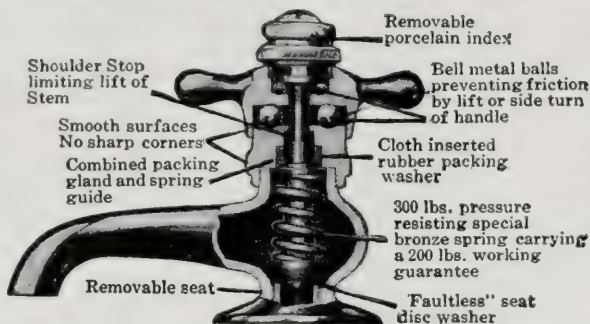
Each branch connection to closet valve or tank shall be ½ inch.

For Water Closets with Flush Valves Having 1¼" Inlets.

Number of Closets	Size of Branch, Inches
1	1¼
2	1½
3	2
4	2½
5	2½
6	2½
7	2½
8	2½
9	3
10	3
11	3
12	3

RYCO Ball Bearing, Self Closing Drinking Fountain and Ice Water Faucet

This fountain is built to last forever. The operating parts are made from a special bronze alloy capable of withstanding the hardest use.



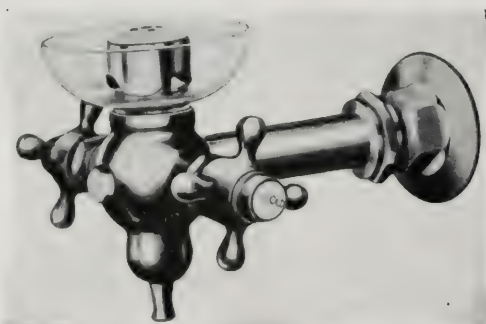
A Combination Bubbler and Ice Water Faucet in Nickel Plated Bronze with China Nozzle and Metal Receptor. Ryco Ball Bearing Self Closing Control Valves, concealed regulating screw, waste to the wall with 1 1/4" female iron pipe size connection and 1/4"

iron pipe size female supply connection being inside the waste.

Regularly furnished 7" from back of flange to center of bubbler.

Also furnished in Nickel Silver or Polished Bronze.

RYCO Ball Bearing, Self Closing Basin Faucets



Nickel Plated Bronze

The operating parts of these faucets are built to withstand the hardest use.

With Lever Handle China Indexed Top.

With 4-Ball China Index Handle.

With Crown Handle China Indexed.

Also furnished in Nickel Silver, and Polished Bronze.

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Each branch connection to flush valve shall be $1\frac{1}{4}$ or 1 inch, according to style of valve used.

In order to prevent water hammer in pipe lines, it is desirable that the supply connection for each flush valve be provided with an air chamber full size of the branch supply and at least 2' in length. In case of a battery of closets, the air chamber may be placed at the extreme end of the horizontal supply branch, and in this case should be at least 2" in diameter and 2' in length for a battery of six to ten. If there should be a double battery of closets placed back to back, the supply branch for each battery should be connected together and the air chamber placed at this point. In that case it would be well to provide an air chamber larger in diameter and at least 4' long.

Refer to table of "Delivering Capacities of Pipes" on Page 511 for sizes of branches where inlets are other than $\frac{1}{2}$ " or $1\frac{1}{4}$ ".

The water pressure must also be carefully considered for flush valves and automatic seat operating valve closets. For the former the minimum should be 15 lbs., and for the latter 20 lbs., at each bowl.

Consumption of water is another item to be considered. Tank closets will use 6 to 8 gallons per flush; those with flush valves from 6 to 8 gallons according to the pressure and automatic seat operating closets will only use $2\frac{1}{2}$ to 3 gallons per flush.

Now regarding urinals—At present there are three types. The solid porcelain or vitreous urinal 18 and 24" wide which sets into floor and has a lipped extension base the top of which is usually set flush with floor. Then there is the old style wall hung urinals—either washdown or siphon jet type.

The first type mentioned is the one most generally used except for factory and school work. The urinal is the most objectionable of all plumbing fixtures and unless it is properly ventilated and gutters contain a sufficient quantity of water for proper dilution of the urine, the fixture becomes a nuisance.

When setting solid porcelain urinals into the floor a depth of 4" is required to bring the top of the drip receptor flush with the finished floor. Care should be taken to set these in accordance with instructions of the manufacturers. They must never be solidly set in a cement grout; an inch or more of dry sand should be put under same and a strip of expansion joint composition placed on the front edge and exposed sides so the concrete sub-base of floor will not adhere. The finished tile, terrazzo or cement may be run up against the porcelain ware.

Regarding the other fixtures such as bath tubs, lavatories, sinks, slop sinks, etc., space will not permit going into details. The catalogues of manufacturers generally give all information necessary regarding same.

Obviously, the main factor determining the selection of fixtures should be quality, which implies the longest possible service and therefore the cheapest in the end. Fixtures in order to prove satisfactory must possess strength and the greatest resistance possible to effects of alkaline and mineral waters and other liquids or material likely to cause stains, or prove destructive to the glazed or enameled surface with which they come in contact. It is always the duty of the architect to make such recommendations to his client as will absolve him from all blame where defects develop in material, that has been used against his recommendation.

The class of the work in question should determine the character of the material to be used throughout, and naturally this will equally apply to the plumbing fixtures.

Vitreous ware of the best quality, is conceded the best and most durable material to

use. In addition to water closet bowls and urinals of certain types, it is furnished for lavatories, drinking fountains, slop sinks and kitchen sinks in certain sizes.

Solid porcelain for larger fixtures, such as bath tubs, stall urinals, slop sinks and kitchen sinks, can be had in Classes A and B. Careful selection is necessary in order to obtain the best and while the danger of crazing of the surface glaze has been greatly reduced by improvements in methods of manufacture, it still remains a point to consider in making a selection.

Quite recently, manufacturers of enameled cast iron ware have introduced a new process of enamel, which they claim will positively resist stains and the surface retain its gloss indefinitely. If this proves to be the case, it will be a great achievement, especially so, if the cost will be but little more than the present best quality of enameled cast iron ware.

By all means provide a clause in your specifications that all fixtures must be stamped with the name of the manufacturer and each piece properly labeled as to quality and showing individual inspection.

Brass Goods:

In order that the Architect may be assured of obtaining durable material great care should be used in the selection of the brass goods which include faucets, bibbs, stops, and supply piping for lavatories, bath tubs, showers, sinks, etc.

For first class work the following clause should be inserted in the specification.

"All brass work shall be red metal brass of a composition in accordance with the Navy Department standard—which is 85% copper, 5% tin, 5% zinc and 5% lead. All tubing such as flush pipes, etc., shall not be less than No. 14 gauge and all supply pipes shall be full iron pipe size, annealed, red brass. All nickel plated work shall be of the highest quality and subjected to the nickeling process for a period of not less than one hour. All faucets, valves and bibbs shall be provided with stems having movable loose discs. Discs to be of special hard fibre and not so called composition and all discs must have edges encased by a brass protecting rim.

Chromium plated metal is now being extensively used in place of nickel plated work. For the very best and most permanent untarnishable material "nickel silver" remains without equal.

"For all concealed valves or stops the operating part must be removable from face of wall and the discs the same as above and the seats of removable, renewable, type."

While on the subject of stops a few words are apropos. The supply connections to every fixture should be provided with stops either exposed or concealed type. The initial cost of stops is very small when compared to the cost of repairing damage to floors, plaster, ceiling and decoration caused by leaks.

Cost today, more than ever, is an important factor in considering the quality of plumbing fixtures that should be used. However, it would be very poor judgment to sacrifice quality of material in any line on account of cost. The work of the Architect is not for today, but for tomorrow, and he who builds well in all things will profit more than one who builds poorly, and hence, now more than ever skill in design and knowledge of materials and their proper use will be required of the Architect to secure results.

Nothing will cause as much annoyance and require as constant repairs as a poorly designed and cheap installation of plumbing. Repair bills are a constant reminder to the owner of mistakes made by the Architect, who failed to give in full the service for which he was paid.

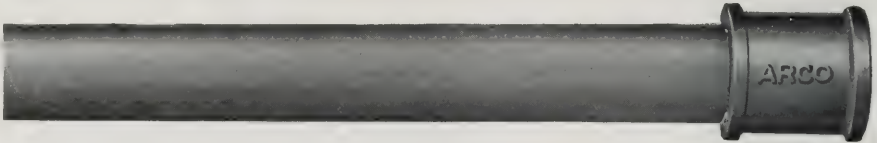
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SOILWASTE AND VENT PIPES IN PLUMBING SYSTEMS

By THOMAS J. CLAFFY

This article is written with the object of presenting information in a convenient form relative to pipe sizes in plumbing systems, for the benefit of those who are interested. More detailed information may be obtained in the report of the Committee, hereafter referred to.

It has long been a recognized fact that definite information was lacking on which to base proper pipe sizes for soil, waste, drain, and rain water pipes within buildings. Architects and Engineers especially have been aware of the lack of uniformity in design and method of installing fixtures and piping systems in plumbing.

The war hastened a concentration of forces to bring about standardization in this respect. Early in 1921, Secretary of Commerce Herbert Hoover set in motion the work of a Committee appointed to bring about a standardization of building practices. Sub-committees were appointed, and the work of bringing about more uniformity of design and practice in plumbing was allotted to a sub-committee composed as follows:

- George C. Whipple, Chairman,
Professor of Sanitary Engineering,
Harvard University.
- Harry Y. Carson, C. E.,
Research Engineer, American Cast Iron
Pipe & Foundry Co.,
Birmingham, Alabama.
- William C. Groeniger,
Consulting Sanitary Engineer,
Columbus, Ohio.
- Thomas F. Hanley,
National Association Master Plumbers,
Contracting Engineer, Chicago, Illinois.
- A. E. Hansen,
Hydraulic and Sanitary Engineer,
New York City, N. Y.
- James A. Messer,
President, James A. Messer Company,
Washington, D. C.
- Albert L. Webster,
Consulting Engineer,
New York City, N. Y.
- William J. Spencer,
Secretary-Treasurer, Building Trades
Council,
American Federation of Labor, Wash-
ington, D. C.

Meetings were held at Washington, and after being duly organized, the Committee decided that its first duty was to define "plumbing." The discussion leading up to this is well worth reading. The definition is:

"Plumbing is the art of installing in buildings the pipes, fixtures, and other apparatus for bringing in the water supply and removing liquid and water-carried wastes."

The Committee's report says that—

"The air in sewers and drains often contains gases resulting from the decomposition of excreta, soap, fats, and other wastes, together with gases from mineral oils which may come from garages, streets, and industrial establishments. Illuminating gas may also find its way into sewers through leakage. Among these gases may be found methane, sulphuretted hydrogen, and carbonic oxide. In large amounts these gases are poisonous to the human system, and there are physiological objections to breathing them even in small quantities. Hence, the air of sewers or drains should be kept from entering build-

ings intended for human habitation or occupancy by the use of proper plumbing installations and by suitable ventilation of the rooms or compartments in which the plumbing fixtures are located. The smell of these gases and other emanations from decomposing organic matter is naturally repugnant to human beings. It not only offends the sensibilities, but may produce shallow breathing, headache and even nausea.

"In addition to the above facts, it is important to consider the bacteriological aspects of sewer and drain air, a subject upon which there has been some misunderstanding. In recent years bacteriologists have made studies which have thrown light upon this subject. They have shown by experiment that while sewage often contains disease-producing bacteria derived from human excreta and body wastes, these bacteria are rarely found in the air which escapes from sewers and drains. Hence, it has been argued by some that escaping sewer air has no influence on health. The committee does not agree with this conclusion. Health may be influenced by factors which do not cause specific diseases, for there are chemical and physiological as well as bacteriological factors involved. The investigations thus far made by bacteriologists should be considered to be merely a beginning of larger and more complete investigations, which will doubtless be made as the science of bacteriology advances. The committee is of the opinion, therefore, that until further light on this somewhat obscure subject has been obtained, the escape of sewer air from the house-drainage system, at frequent intervals or in considerable quantities, threatens the health of the building's occupants.

"The temporary losses of water seal in traps, which rarely occur and which are immediately replaced, do not involve any great danger to the health of the occupants, * * * but where a loss of seal is likely to be of frequent occurrence and not readily replaced, or where breaks in the system admit sewer air continually to a building, the health of the occupants is subject to the dangers heretofore described.

"For the above mentioned reasons, regulations governing the installation of plumbing have been established by law in many places. These regulations have been potent in improving living conditions throughout the country; in fact, they have even set the standards for those places where plumbing is not under public control.

"The committee believes that good plumbing is a matter which concerns health. Government has the right to protect the people's health, * * *."

This is the basis upon which is built all laws, rules, and regulations concerning plumbing installations within buildings.

The National Plumbing Code, prepared and submitted in the report of this Committee, is well worth a place in every architect's library. It is designed so as to apply in every part of the United States, and is national in its scope. The primary object was to standardize plumbing in small residences. That this has been well done is obvious.

In the report of this sub-committee as submitted for the year ending December, 1929, certain revisions are made in the tables of pipe sizes which are more in harmony with present practices.



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The members of this committee are:

- *George C. Whipple, Chairman.
- Harry Y. Carson.
- William C. Groeniger.
- August E. Hansen.
- J. L. Murphy.
- John M. Gries, Chief of the Division of Building and Housing.
- George N. Thompson, Secretary.
- R. B. Hunter, In charge of Tests.

*Deceased.

Experiments.

Numerous practical experiments were carried out by the Bureau of Standards at Washington and by the Department of Sanitary Engineering at Harvard University, which aided this Committee in forming its conclusions. These experiments confirmed the findings of those whose experiences in tall building construction have been previously related.

The tables of pipe sizes are on a fixture unit basis, which is the most convenient form to use.

Table of Pipe Sizes.

"Fixture Unit: The following table based on the rate of discharge from a lavatory as the unit shall be employed to determine fixture equivalents:

	Fixture Units
One lavatory or wash basin.....	1
One kitchen sink	1½
One bathtub	2
One laundry tray	3
One combination fixture.....	3
One urinal	3
One shower bath.....	3
One floor drain.....	3
One slop sink.....	4
One water-closet	6

"One bathroom group consisting of one water-closet, one lavatory, one bathtub, and overhead shower, or one water-closet, one lavatory and one shower compartment, shall equal 8 fixtures."

"One hundred and eighty square feet of roof or drained area in horizontal projection shall count as one fixture unit."

Vents, Required Sizes.

The required size of main vents or vent stacks shall be determined from the size of the soil or waste stack vented, the total number of fixture units drained into it, and the developed length of the vent, in accordance with the following table, interpolating when necessary between permissible lengths of vent given in the table:

Maximum Permissible Length of Units (in feet) for Soil and Waste Stacks.

Diameters of soil or waste stack (inches)	Number of Fixture Units	DIAMETER OF VENT (In Inches)									
		1¼	1½	2	2½	3	4	5	6	8	10
1¼.....	1	45									
1½.....	Up to 8	35	60								
2.....	Up to 18	30	50	90							
2½.....	Up to 36	25	45	75	105						
3.....	12		34	120	180	212					
3.....	18		18	70	180	212					
3.....	24		12	50	130	212					
3.....	36		8	35	93	212					
3.....	48		7	32	80	212					
3.....	72		6	25	65	212					
4.....	24			25	110	200	300	340			
4.....	48			16	65	115	300	340			
4.....	96			12	45	84	300	340			
4.....	144			9	36	72	300	340			
4.....	192			8	30	64	282	340			
4.....	264			7	20	56	245	340			
4.....	384			5	18	47	206	340			
5.....	72			40	65	250	390	440			
5.....	144			30	47	180	390	440			
5.....	288			20	32	124	390	440			
5.....	432			16	24	94	320	440			
5.....	720			10	16	70	225	440			
5.....	1,020			8	13	58	180	440			
6.....	144					27	108	340	510		
6.....	288					15	70	220	510	630	
6.....	576					10	43	150	425	630	
6.....	864					7	33	125	320	630	
6.....	1,296					6	25	92	240	630	
6.....	2,070					4	21	75	186	630	
8.....	320						42	144	400	750	900
8.....	640						30	86	260	750	900
8.....	960						22	60	190	750	900
8.....	1,600						16	40	120	525	900
8.....	2,500						12	28	90	370	900
8.....	4,160						7	22	62	252	840
8.....	5,400						5	17	52	212	705

Soil and Waste Stacks.

"Every building in which plumbing fixtures are installed shall have a soil or waste stack, or stacks, extending full size through the roof. Soil and waste stacks shall be as direct as possible and free from sharp bends

and turns. The required size of a soil or waste stack shall be determined from the distribution and total of all fixture units connected to the stack in accordance with the following table, except that no water-closets shall discharge into a stack less than 3 inches in diameter."



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MAXIMUM FIXTURE UNITS ON ONE STACK

DIAMETER (inches)	With "Sanitary T" Inlets		With all 45° Y or "Combination Y and One-eighth Bend" Inlets		Maximum length, in- cluding extension as vent
	In one branch interval ¹	On any one stack	In one branch interval ¹	On any one stack	
1 1/4	1	1	1	1	Feet 50
1 1/2	2	8	4	12	65
2	9	16	15	36	85
3	24	48	45	72	212
4	144	256	240	384	300
5	324	680	540	1,020	390
6	672	1,380	1,122	2,070	510
8	2,088	3,600	3,480	5,400	750

¹The term "branch interval" shall be interpreted to mean a vertical length of stack, not less than 8 feet, within which a branch or branches are connected, and the total fixture units on all branches connected to a stack within any 8-foot length shall not exceed the maximum permitted by the table in one "branch interval."

Branch and Individual Vents.

No vents shall be less than 1 1/4 inches in diameter. For 1 1/4 and 1 1/2 inch wastes the vent shall be of the same diameter as the waste pipe, and in no case shall a branch or main vent have a diameter less than one-half that of the soil or waste pipe served, and in no case shall the length of a branch vent of given diameter exceed the maximum length

permitted for the main vent serving the same size soil or vent stack.

Size of Drains, Sewers, and Horizontal Branches.

The required size of sanitary house drains, sanitary house sewers, and horizontal branches shall be determined on the basis of the total number of fixture units drained by them in accordance with the following table:

SANITARY SYSTEM ONLY

Diameter of Pipe (Inches)	Maximum Number of Fixture Units			Diameter of Pipe (Inches)	Maximum Number of Fixture Units		
	Slope 1/8 inch fall to 1 foot	Slope 1/4 inch fall to 1 foot	Slope 1/2 inch fall to 1 foot		Slope 1/8 inch fall to 1 foot	Slope 1/4 inch fall to 1 foot	Slope 1/2 inch fall to 1 foot
1 1/4	1	1	1	5	162	216	264
1 1/2	2	2	3	6	300	450	600
2	5	16	18	8	990	1,392	2,220
3	215	218	221	10	1,800	2,520	3,900
4	84	96	114	12	3,084	4,320	6,912

NOTE—¹No water-closet shall discharge into a drainpipe less than 3 inches in diameter.

²Not more than two water-closets shall discharge into any 3-inch horizontal branch, house drain, or house sewer.

The required sizes of storm-water house drains and house sewers and other lateral storm drains shall be determined on the basis of the total drained area in horizontal projection in accordance with the following table:

STORM SYSTEMS ONLY

Diameter of Pipe (Inches)	Maximum drained roof area (square feet) ¹			Diameter of Pipe (Inches)	Maximum drained roof area (square feet) ¹		
	Slope 1/8 inch fall to 1 foot	Slope 1/4 inch fall to 1 foot	Slope 1/2 inch fall to 1 foot		Slope 1/8 inch fall to 1 foot	Slope 1/4 inch fall to 1 foot	Slope 1/2 inch fall to 1 foot
3	865	1,230	1,825	8	11,115	15,745	24,890
4	1,860	2,610	4,170	10	19,530	27,575	43,625
5	3,325	4,715	7,465	12	31,200	44,115	69,720
6	5,315	7,515	11,875	14	42,600	60,000	95,000

¹The calculations in this table are based on a rate of rainfall of 4 inches per hour.

Combined Storm and Sanitary Sewer Systems.

Whenever a combined sewer system is employed, the required size of the house drain or house sewer shall be determined by multiplying the total number of fixture units carried by the drain or sewer by the conversion factor corresponding to the drained area and total fixture units, adding the product to the drained area and applying the sum to the preceding table for storm-water sewers

section *115. No combined house drain or house sewer shall be less than 4 inches in diameter, and no combined house drain or house sewer shall be smaller in size than that required for the same number of fixture units or for the same roof area in separate systems.

*Note—Section 115—See following table.

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CONVERSION FACTORS FOR COMBINED STORM AND SANITARY SYSTEM.

Drained Roof Area, in Square Feet	NUMBER OF FIXTURE UNITS ON SANITARY SYSTEM																
	Up to 6	7 to 18	19 to 36	37 to 60	61 to 96	97 to 144	145 to 216	217 to 324	325 to 486	487 to 732	733 to 1,098	1,099 to 1,644	1,645 to 2,466	2,467 to 3,702	3,703 to 5,556	Over 5,556	
Up to 120.....	180	105	60	45	30	22	18	15	12	10	9.2	8.4	8.2	8.0	7.9	7.8	
121 to 240.....	160	98	57	43	29	21	17.6	14.7	11.8	9.9	9.1	8.3	8.1	8.0	7.9	7.8	
241 to 480.....	120	75	50	39	27	20	16.9	14.3	11.5	9.7	8.8	8.2	8.0	7.9	7.8	7.7	
481 to 720.....	75	62	42	35	24	18	15.4	13.2	10.8	9.2	8.6	8.1	7.9	7.9	7.8	7.7	
721 to 1,080.....	54	42	33	29	20	15	13.6	12.1	10.1	8.7	8.3	8.0	7.8	7.8	7.7	7.6	
1,081 to 1,620.....	30	18	16	15	12	11.5	11.1	10.4	9.8	8.4	8.1	7.9	7.7	7.7	7.6	7.5	
1,621 to 2,430.....	15	12	11	10.5	9.1	8.8	8.6	8.3	8.0	7.9	7.8	7.7	7.6	7.5	7.4	7.4	
2,431 to 3,645.....	7.5	7.2	7.0	6.9	6.6	6.5	6.4	6.3	6.2	6.3	6.4	6.4	6.8	7.0	7.1	7.2	
3,646 to 5,460.....	2.0	2.4	3	3.3	4.1	4.2	4.3	4.4	4.5	4.7	5.0	5.1	6.1	6.4	6.9	6.9	
5,461 to 8,190.....	0	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.8	3.2	3.7	4.6	5.0	5.6	6.2	6.4	
8,191 to 12,285.....	0	0	2.0	2.1	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.7	3.5	4.5	5.2	5.6	
12,286 to 18,420.....	0	0	0	2.0	2.1	2.1	2.2	2.2	2.3	2.3	2.4	2.4	2.6	3.2	4.2	4.7	
18,421 to 27,630.....	0	0	0	0	2.0	2.1	2.2	2.2	2.2	2.3	2.3	2.3	2.4	2.5	2.8	3.1	
27,631 to 40,495.....	0	0	0	0	0	2.0	2.1	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.3	2.4	
40,496 to 61,520.....	0	0	0	0	0	0	2.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	
Over 61,520.....	0	0	0	0	0	0	0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	

In order to arrive at an understanding of what these tables mean, let us—

Assume a 3 story 12 flat building 100' x 75'. This gives a roof area of 7,500 square feet.

There would be 12 complete bathrooms, 12 kitchen sinks, 4 laundry tubs and 4 laundry water-closets.

Applying the formula for fixture units as described elsewhere, we would have a total of 162 fixtures.

From the table of conversion factors for combined drainage systems, we find that for 7,500 square feet of roof and 162 fixtures, the factor is 2.5.

Following the rule we proceed:

$$162 \times 2\frac{1}{2} = 405$$

$$7,500 \times 405 = 7,905 \text{ square feet.}$$

By referring to the storm-water drainage section, we have—

$$7,905 \text{ sq. ft.} = 8 \text{ in. sewer @ } \frac{1}{8} \text{ in. pitch}$$

$$7,905 \text{ sq. ft.} = 8 \text{ in. sewer @ } \frac{1}{4} \text{ in. pitch}$$

$$7,905 \text{ sq. ft.} = 6 \text{ in. sewer @ } \frac{1}{2} \text{ in. pitch}$$

Our experience in Chicago is that a 6 in. sewer at $\frac{1}{4}$ in pitch is adequate for the storm-water and sanitary sewage from such a building.

Chicago is built on a flat plain. It has a combined system of sewerage resulting in flooded basements and cellars where good engineering practice in the design of the house system has been ignored. There can be no permanent relief until the city has been provided with storm sewers or the drainage in existing buildings remodeled.

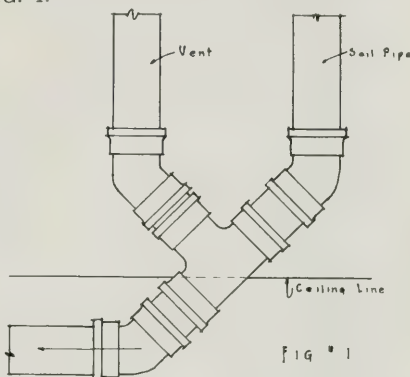
Common sense tells us that a storm-water drainage system must be designed and installed in the near future. It will prevent great annual loss in the destruction caused by flooding of basements and will mean economy and efficiency in the operation of sewage treatment plants.

NOTE.—See article on Plumbing Design in Tall Buildings, Page 517, 1922 Year Book.

Study of the reference to a full size cross connection between soil or waste line and vent is well worth while in connection with the above tables.

Good practice would not permit the installation of a vertical waste carrier two to four hundred feet long without a break in it. At the angle fitting in such a break a full size connection between soil or waste line and vent should be made as suggested in the 1922 Year Book.

FIG. 1.



Method of connecting a main vent line into the bottom of a soil or waste line in a tall building to prevent excessive air compression.

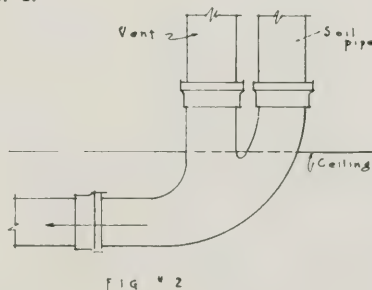
The falling column of water hugs the bottom of the 45° angle extension and allows the air to separate from the water and freely escape up the vent line.

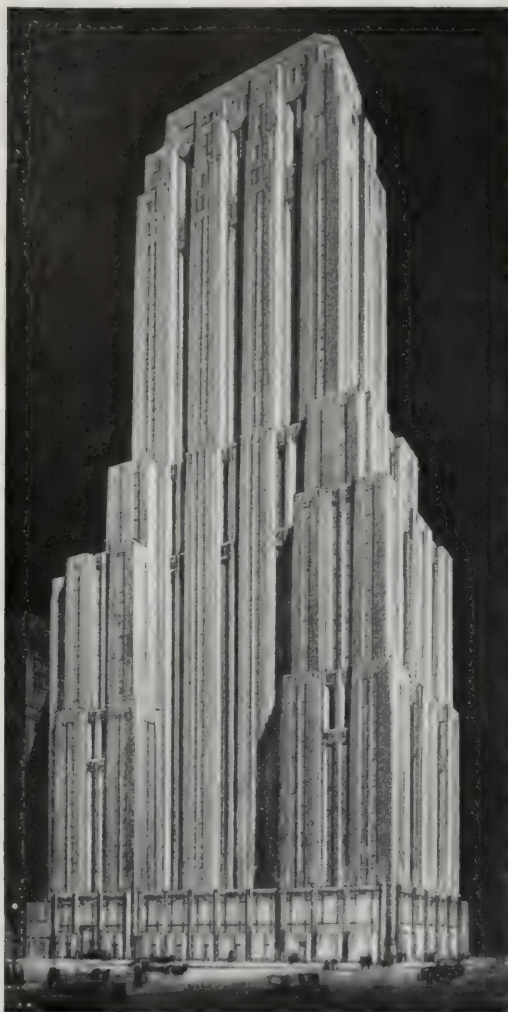
Experiments and actual installations prove this method to be correct.

Another method of connecting a main vent at the bottom of a soil or waste stack. This is a stock fitting for cast iron pipe.

Operation is the same as that in Fig. 1.

FIG. 2.





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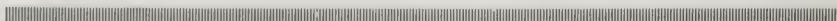
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STAINS, FILLERS, VARNISHES AND ENAMELS

By R. W. LINDSAY, CHEMIST

Only a few decades ago varnish making bordered on an occult art. The formulas and rule-of-thumb methods used by different manufacturers were so zealously guarded that the interest of others did not reach back of the finished product. Then the chemist entered the field. He made an exhaustive study of the properties given to varnish and its allied products by the different materials entering into their manufacture. Thus equipped, he was able to make products exactly adapted to all of the increasing number of purposes for which finishing materials are used. This means that to-day the architect can find excellent materials for any finish that he may wish to secure; but this bewildering variety of materials also means that he must give more thought than ever before to his selection. Should I specify an acid stain or an oil stain? Why should I use varnish instead of shellac on floors? These are samples of the hundreds of questions that can be answered intelligently only when the solution is based upon a comprehensive, organized knowledge of the materials available. And for the one who will delve deeply enough, it is a study as fascinating as it is profitable.

In considering the above subject it will be necessary to divide this treatise into four distinct classes in accordance with the title.

Stains.

The subject of stains may be divided into four parts, as follows:

- 1st.....Aniline Oil Stains
- 2nd.....Aniline Spirit Stains
- 3rd.....Pigment Oil Stains
- 4th.....Acid Stains

By the aniline oil stain is meant a stain made by the solution of an aniline color in some solvent such as benzol, solvent naphtha, turpentine, benzine, or in other words, an oil solvent. Often in combination with these aniline colors is used a considerable amount of asphaltum varnish in order to obtain certain desired results. There has always been, and still is, a great deal of doubt in the minds of most users as to just what is meant by an aniline color and when we consider the great number of organic compounds known as aniline colors, it is not strange that such is the case. By an aniline color we mean one derived from the chemical compound aniline which is found in coal tar. Aniline is then treated with various acids and other chemicals and we are able to form new compounds and from these compounds still other compounds, and it is these various new compounds which are formed that are the aniline colors of commerce. These colors vary in their solubility according to their composition and consequently we have aniline colors soluble in oil, aniline colors soluble in alcohol, aniline colors soluble in water and in addition we have also many aniline colors, which we may say are "forced" in their solubility, i. e., the aniline color may be only slightly soluble in a solvent such as benzol, but when combined with a fatty substance such as stearic or oleic acid, which is soluble in benzol, is carried into solution in this way. This latter fact accounts as you may readily understand for the non-drying nature of many of the oil anilines. The aniline color itself may be a material which would be perfectly dry, but of course, is not permitted to become so on account of the presence of these non-drying fatty acids.

The aniline oil stains have very strong penetrating powers and carry the dye far

into the wood. They may be used on both hard and soft woods, both open and closed grains, but naturally better penetration is secured in the softer woods. These stains, being perfectly clear and containing no pigment, produce a beautiful, clear, transparent stain, usually rich in color and beautiful to look upon. This beauty is of course brought out by the application of shellac and varnish.

In finishing a panel with a stain of this nature we find that the stain works very easily, giving a remarkably uniform effect and apparently is an excellent product. Shellac is then applied and later the varnish and the brilliancy of the stain is very much enhanced. Supposing that we have a panel finished up in this way and the same is allowed to be set aside for some time and then later examined, we are very much surprised to find that, first, instead of having a stain rich in color that a great deal of its depth has disappeared and left in many cases, a muddy effect. At any rate the stain has faded very considerably. Secondly we notice that the varnish itself has died down very materially and that upon scratching the varnish film, we have instead of a firm, tough finish, a finish which looks very much as though it were made entirely of rosin. This latter effect is due entirely to what is termed "Bleeding" of the stain due to the following conditions: The stain as applied, was, as stated above, composed of aniline colors soluble in benzol, turpentine and other solvents of a similar nature, and consequently upon application of the shellac over the stain, the alcohol penetrated into the pores and dissolved out a certain part of the stain and carried it into its own film. The varnish, then following, also having the power by means of its thinner, to dissolve this dye, picks up the color and carries it into its own film. These colors are extremely susceptible to this kind of an action and have been known to have carried sometimes through five or six coats of paint. There is one case, which has come to my attention, where there has been applied over a finish of this kind two coats of varnish and five coats of white enamel, yet after each successive coat of enamel has dried, the pinkish cast of the mahogany aniline stain has appeared and cannot be removed unless the entire finish down to the wood is taken off and the color itself removed. Naturally the layman in having his house finished and noticing the condition of his wood finish from time to time, detects the falling of the lustre of his varnish and immediately draws the conclusion that the varnish applied to his house is of an inferior quality and it is my presumption that the reputation of the varnish manufacturer has been harmed a great deal more than we realize by such conditions. Of course, many of the manufacturers of stains of this nature do produce what are called primers, which are supposed to take care of this "Bleeding" effect and no doubt these articles do retard the "Bleeding" very considerably, yet there are none which are absolutely free from this trouble.

In this same class of materials of a somewhat different construction, are the **spirit stains**. These, of course, are made by a solution of aniline colors in alcohol and only used to a very limited extent on account of the fact that they are extremely hard to work and apply evenly, it being almost impossible to apply a stain of this character on a large surface with any degree of even-



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ness, and secondly, they are prone to work up into the shellac applied over them, so that it is almost an impossibility to get a good finish. They naturally "bleed" very considerably and have caused all kinds of trouble not only in this respect, but also in regard to their fading. Being used in such limited quantities as they are, it is not necessary to describe them further, but merely to state that they should be avoided.

The third type of stain mentioned above is what is termed **pigment stains**, and by such is meant one made by grinding of a pigment or pigments in oil, usually linseed oil, and its subsequent reduction with turpentine or some such vehicle sufficient to effect penetration. The pigments used in stains of this kind are:

Ochres
Siennas
Ambers
Chrome Yellows
Chrome Greens
Carbon Black
Prussian Blue
Para Reds, etc.

and as you can readily see, their staining effects must be really due to the lodgment of the pigment within the pores of the wood. In reality they are nothing but a thin paint sufficiently reduced so as to penetrate the pores of the wood. These stains do not give as clear an effect as the penetrating stains nor do they penetrate the wood so readily, and consequently are limited almost entirely to soft woods where a sufficiently deep penetration may be effected. However, even though these stains are not quite as clear as the previously discussed class of stains, yet they are sufficiently clear to produce some very beautiful effects and when we consider the fact that they are practically non-fading, have absolutely no tendency to "bleed" and that the after results are consequently very much more satisfactory than otherwise, we must concede that they are far superior to any stain in which the after-results are very questionable. Furthermore, these stains being made upon a linseed oil base, have a tendency to preserve the wood and consequently are of material assistance in this way.

The third class of stains mentioned above are the **acid stains**. The term acid, applied to most of these stains is a misnomer on account of the fact that nearly all of these stains of this class are practically neutral in their reactions, i. e., they are not made by the solution of acids in water as the same suggests but are made by the solution of various dyes in water or a medium miscible with water. These stains are perfectly clear solutions and when applied to the work, they work very easily under the brush and may be spread out over large areas with a degree of evenness. Having been applied, and the work finished, they are very permanent as regards fading and have little tendency to "bleed".

The reason for the latter effect is due to the fact that the dye used is a water soluble product and consequently even though the vehicle of the varnish applied over the stain may penetrate into the wood, yet the dye is not picked up and consequently does not "bleed" into the successive coats of varnish. This point may be very readily illustrated by carrying out the following experiment: A panel, for example, is finished at one end with coat of mahogany aniline oil stain and at the other with a coat of mahogany acid stain and a coat of shellac is applied over the entire panel, followed by a coat of white enamel. Allow this panel to stand for a short time and the result is, that within a very short period of time, it will be noticed that the enamel over the aniline oil stain is covered with reddish spots, showing the way in which the "bleeding" has taken place. The enamel over the acid

stain has not been affected, thus indicating the "non-bleeding" nature of this stain. These acid stains produce beautiful, clear, transparent effects, are permanent and "non-bleeding" and are really the ideal kind of stain, but like many other materials which are so nearly perfect, they have one defect. This defect is due to the fact that when the water is applied to wood, the grain is caused to raise very materially and it is the sanding down of this grain, which restricts somewhat the use of the acid stain. The acid stain is confined almost entirely to the use of hard woods on account of the fact that the softer woods necessitate a large amount of sanding. The best practice is, of course, to sponge off the wood first, sand and then apply the stain and follow with another light sanding. In this way, the maximum amount of stain is retained in the wood and the effect is not spoiled. Notwithstanding this defect, however, these stains are really the most practical, most lasting and produce the most satisfactory results.

FILLERS.

This class of materials may be divided into two parts:

Liquid Fillers.

Paste Fillers.

When Liquid Fillers were first placed on the market, they were offered as substitutes for shellac and at that time the material sold as such was of far better quality than most of the so called Liquid Fillers of today. Today, most of these goods are composed of nothing more than Gloss Oil, a little Linseed Oil and the cheapest Pigment it is possible to get. All kinds of pigments have been used but the most satisfactory are either asbestos or China Clay on account of the property these pigments have of remaining in suspension. Notwithstanding the fact however, that the general run of Liquid Fillers has deteriorated so much, a few of the best manufacturers are producing goods for this purpose which really have quality. These goods are necessarily made so that they dry very hard and firm, carry sufficient pigment so as to fill the pores to a certain extent and give a surface which is very non-absorbent and over which the varnish may be applied in such a way as to have a good full body and lustre. This class of materials is not recommended for use upon floors or for exterior purposes on account of its extremely hard nature, yet for certain purposes, it serves in a very favorable way, and may be recommended.

The second type of filler is the **PASTE FILLER** and by this product we mean one sold in paste form and made by mixing or grinding together of certain pigments, linseed oil and a japan drier. The function of a paste wood filler is to close all the pores of the more or less open grained woods, so that, while the surface becomes non-absorbent, the natural beauty is not obscured, and if the wood is stained, the filler must not dull the transparency of the stain. Therefore, the more translucent the filling material, the more valuable the product. Consequently, while barytes, clay whiting and gypsum are still employed on account of their cheapness, the ideal material for a filler is siliceous or silica. Siliceous or silica is really powdered quartz, and is a pigment which is extremely transparent, has considerable "tooth," and consequently makes an ideal pigment for this purpose. A paste filler is generally made by merely mixing the silica and its vehicle, and is received by the consumer in paste form. This is reduced with turpentine, and is then ready for application. A good filler should be dry in twenty-four hours, and then sanded and dusted off, leaving a surface ready for the application of the material following.

Fillers are really materials to which suf-

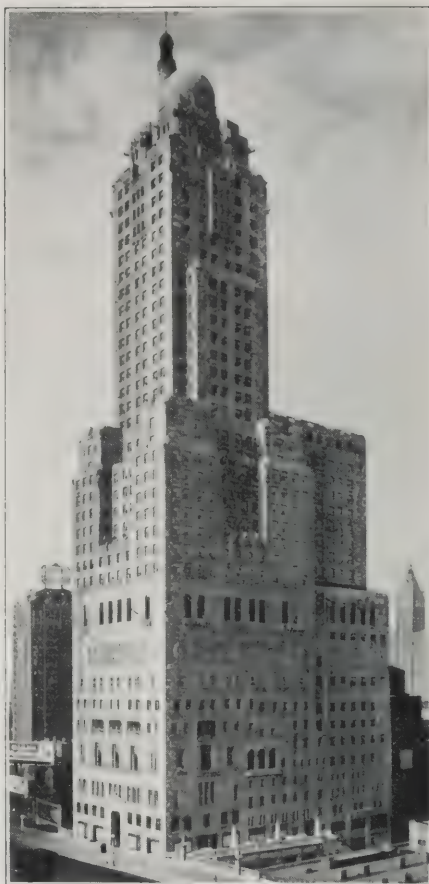
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ficient attention has not been given, and it behooves the architect to see that he gets the most translucent fillers possible even though the same costs him a little more, this extra expense being do doubt explained very largely by the fact that the pigment used is more expensive. Furthermore, the best grade of fillers always contain a good grade of linseed oil and a good gum Japan, the latter serving to harden up and to make the filler non-absorbent. Here, again, the use of a cheap filler necessarily means the use of a material containing a cheap Japan which will have the effect of reducing the durability and stability of the filler. Colored fillers for various modern effects are, of course, made up by incorporating certain colors with the regular paste filler and some very beautiful results may be obtained.

VARNISHES.

This subject should be divided into two parts, as follows:

Spirit Varnishes.

Oil Varnishes.

After the wood has been properly filled, it is customary, both in architectural and industrial work, to apply a coat of spirit varnish. For many years practically no material was used for this purpose but shellac.

Gum shellac, as you are no doubt aware, comes to us very largely from India and is a resin produced by the bite or sting of certain insects on the small twigs of several species of East Indian trees. The resin appears to be formed from the plant sap by the female insect from whose body it exudes, ultimately burying the insect and her eggs and forming a thick excrecence on the twigs. This is collected, macerated with warm water to extract a dye and the residue (Seed Lac) is refined by melting and straining. It is then poured in thin films on wooden cylinders when it hardens and scales off in thin flakes and is then called "shellac."

Bleached shellac is made by passing a stream of chlorine gas into an alkaline solution of shellac. There are on the market a number of grades of shellac, due to the fact that during the melting process, rosin is added to facilitate the melting process. The result is that we have a great many products termed shellac which contain a very large proportion of rosin and many which contain absolutely no gum shellac.

Due to the extremely high cost of shellac there has come upon the market a large number of shellac substitutes and, as with all other varnishes, there are many which can be used with a high degree of satisfaction and many which are absolutely worthless. Most of the better grades of shellac are made by dissolving certain spirit copal gums in alcohol. On the other hand, there are a large number of shellac substitutes which are made on a rosin base or at least contain a large proportion of rosin so as to make a substitute which is satisfactory only from the standpoint of price.

To my mind, one of the most important points in an architect's specification is the question of the character of the spirit varnish which is applied over the filler; for the reason that, just as no house can be built with a foundation of sand, so no finish should be built up with a foundation coat which has no durability, is extremely brittle and has in fact no qualities to recommend it except that of cheapness. An architect in recommending a manufacturer's grade of substitute shellac has, of course, the assurance of the house manufacturing that goods that it will be satisfactory. On the other hand, as an architect specifies "shellac" and does not definitely specify as to the grade of shellac, he cannot be certain as to the results. It might be well to suggest that if an architect desires that shellac be used, he write a specification like that of the Government which compels the use of a shellac con-

taining no rosin nor other adulterants. With the extremely high cost of shellac at the present time, architects will find it well worth their time to consider shellac substitutes made by reputable manufacturers for work where it is not necessary to secure the very highest grade of finish.

We now come to the subject of Oil Varnishes, and in taking up this matter we will discuss the various materials used in varnish making and follow this with a brief description of the process itself.

Varnish has four main constituent parts.

First: The fossil resins, or gums, as they are termed, which give to the varnish its brilliancy and lustre and to a certain degree its durability.

Second: The drying oils which render the varnish elastic, durable and to a certain extent affect the lustre.

Third: The metallic driers which are incorporated with the oils to hasten the drying of the varnish film, acting as carriers of oxygen from the air to the drying oil.

Fourth: The volatile solvents which aid in the spreading of the varnish upon the work.

First we shall take up the various raw materials used in making varnish, and describe the source from which these various materials come, and then later, the way in which these materials are used in the actual varnish making process.

The first of the raw materials to be considered are the resins, which are divided into three classes. We first have the fossil resins, which are the exudation of trees which existed thousands of years ago, the sap having flowed from the trees to the ground where it was covered with decayed vegetation, etc., and fossilized. Second, we have the semi-fossil resins, which are the exudation of trees of more recent origin, and third, we have the crop resins, which are gathered directly from the tree, the tree being cut in such a way that the sap will flow and this sap is hardened by oxidation.

Zanzibar Animi is a fossil resin coming to us from Zanzibar on the eastern coast of Africa, and is characterized by the goose skin effect which we find upon the various pieces of gum. The gum is extremely hard, and was formerly used in the manufacture of our best grade of piano varnishes and interior varnishes. It was used in the piano varnishes on account of the fact that it makes an extremely hard varnish, and one which may be readily rubbed and polished. It was used in the spar varnishes on account of the fact that it made a varnish which was very durable. This resin is not used today on account of the fact that it is practically impossible for us to obtain sufficient quantities for use in a practical way.

The next resin is that of the Congo Copal, the term Copal being applied to the gum found upon the west coast of Africa, to differentiate between these and the ones found on the east coast of Africa, of which the Zanzibar is a type. The Congo Copal is very light in color, makes a varnish which dries with a good hard film, and is used in large quantities in high grade varnishes. For this reason it is used in high grade baking varnishes and interior varnishes where color is an essential feature.

The Benguela Copal is very similar to Congo, coming from the same general district on the west coast of Africa, but differs in that the varnishes made from this gum are darker. The Benguela is characterized by the greenish cast which is displayed throughout the various pieces of gum.

The Sierra Leone Copal is one of the most elastic resins known to the varnish maker. For this reason it has been used with wonderful success in the pale coach and car var-

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nishes and in spar varnishes, where elasticity is the most essential feature. At the same time it makes a varnish which has a very light color, and for this reason it is also very suitable for pale baking varnishes and also for varnishes where elasticity is a most important factor. This resin comes to us also from the west coast of Africa, coming from the district of Sierra Leone.

The next class of resins is the Kauri, coming to us from an entirely different region—from New Zealand. Kauri is one of the most popular resins in the varnish industry on account of the fact that by it may be made a most durable varnish, and also a varnish which is excellent for rubbing and polishing purposes, due to the fact that when this resin is handled properly varnish may be made which has less tendency to "sweat out" in the process of rubbing than a varnish made with other gums. Furthermore, Kauri has very good durability, and is consequently used in the high grade exterior varnishes. Kauri comes to us in various grades, ranging greatly in physical characteristics and price. The better quality Kauri, for instance, costs at the present time \$.90 per pound. The No. 1 Kauri costs \$.50 per pound, while the Brown Kauri costs \$.15 per pound. The varnishes made with these various grades of Kauri have, of course, the same general properties, yet differ so considerably that it is most important that the grade of gum be considered very carefully in the manufacture of a varnish.

The Manila Copal is a type of the resins which are termed soft resins, and comes to us mostly through the port of Manila, being found largely in the East Indies. White Manila is used a great deal in the cheaper interior and medium priced varnish, and when handled properly some very good results can be obtained. However, it carries quite a large amount of free acid and has the property of causing a varnish to have a softer film than one made with the Kauri or the other harder gums. Manila, like Kauri, comes to us in various grades, the best being the White Manila and a cheaper grade being the Manila Nubs, which is a form very popular with the varnish manufacturers on account of the fact that the Manila Nubs, being small pieces, are much easier to handle than the White Manila, which comes in extremely large pieces. The Manila gum is derived from one of the most prolific gum-bearing trees known, and some of the pieces of gum which have been found are very large in size, being sometimes two or three feet in diameter.

The Damar resin is a gum which is probably very familiar, having been used for years in the manufacture of Damar varnish. Its one important feature is its color, and that is about all which we can say for it. It has no durability, is very soft, and a resin with a very low melting point, so that it cannot be used in any of our high grade varnishes. Damar resin has been used for a great many years for the manufacture of white enamels and for a considerable length of time all the white enamels on the market were made upon this base. Today, however, the highest grade of white enamels contain no Damar on account of the fact that it is lacking in durability. We still, however, have a great many cheaper, quicker drying, and less durable enamels, which are made upon a Damar base.

The Asphaltum is not really a resin, being a cross between soft coal and petroleum, and comes to us largely at the present time from Utah. This bituminous material is used in the manufacture of our black air drying and baking japans, being used largely upon iron work.

While the above does not describe all of the resins which are used by the varnish-maker, yet it gives an idea of the various

properties which the varnishmaker obtains by using the different grades and kinds of resins, and we shall now proceed to give a brief description of the various ways in which these resins are gathered. As mentioned above, these resins are formed by a fossilization of the sap, which came from trees, which existed thousands of years ago, and it is of particular interest that many of these resins are found as deep in the earth as twenty or more feet.

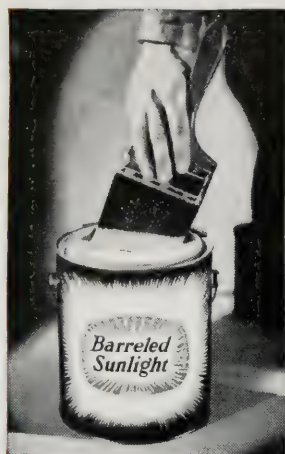
The gum digging industry in the early days, particularly in New Zealand, was for many years carried on in a desultory manner, with the result that practically no gum was procured except that which lay on the surface. The gum diggers in the olden days would start out in the morning with what they termed their prodding stick and knapsack on their backs and by the use of this stick would determine places where the gum could be found. They would proceed to dig up the gum and carry it with them until evening, when they would sit around their camp fires and scrape the gum and prepare it for the market. Today, however, the gum digger is more like our modern miner. He starts off with his various prospecting sticks, his spade and coarse tooth saw, with which he saws around the roots and moss in order to unearth the gum. The surface of the earth, is then dug up and the gum and dirt thrown to one side. This digging goes on until at times we find diggers have proceeded to a depth of twenty feet below the surface of the earth in their search of gum. The gum is then thrown upon a screen, where it is washed and the earth and other decayed matter separated from it. The gum is then all scraped and sorted, and then carried down to a general warehouse, where it is further sorted and graded. The gum is then taken to the brokers' warehouse where it is further sorted by men who have wide experience in this line. These men start as mere boys, first working on the cheaper gums and then they are gradually promoted to work on the higher grades of gum. This is very important work when we realize the variations in its price. The gum is then put into bins, and from the bins is packed in cases, then shipped to foreign ports.

Gradually during the past few years synthetic resins have attained wide spread use due to their special affinity for China wood oil. The most outstanding synthetic resin and the one which has been used for the greatest length of time is Ester Gum, usually manufactured by chemically combining rosin and glycerine. In the course of the reaction the rosin and glycerine lose their identities and there results an entirely new substance of unique properties—a rosin ester gum.

Ester Gum dissolves readily in oil and thinner, produces a much lighter colored varnish than a fossil resin, is more waterproof but has not, of course, the ultimate hardness usually required for good rubbing and polishing properties.

Copal Esters made by combining Congo or one of the fossil resins with glycerine are used to a very limited degree.

Recently other synthetic resins of radically different nature have been developed and these newer resins are largely responsible for the so called four-hour varnishes and enamels which have recently made their appearance upon the market. These new synthetic resins are produced by the reaction under certain conditions of different chemical compounds of which carboic acid and formaldehyde are the best known. These resins have the valuable property of causing rapid drying of the oil by producing an entirely new effect to which has been given the name "Jellation." This effect causes the varnish to set very quickly and dries on the surface very rapidly, although not hardening through at the corresponding rate.



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We now pass on from the subject of gums to that of oils, and the first oil we shall mention is, of course, Linseed Oil, which is made from the flaxseed grown in Canada, United States, Argentine, India, and around the Baltic Sea, and it is very curious to note that the oil from these various parts of the world should differ so much, due probably to climatic conditions and also to methods of harvesting.

The flax is cut in the field and the flaxseed is then separated from the flax stalk. This seed, in the case of that grown in our own country, is then carried to the various lake ports and comes down the lakes in large grain boats. The seed is then conveyed from the boats to the grain elevator, and is separated according to the various grades and the source from which it comes; it is then carried by means of large conveyors to the rolls. These consist of large steel corrugated rolls between which the seeds pass until they are entirely crushed into the form of a fine powder. This powder is then emptied into the tempering kettle on the floor below, where a certain amount of moisture and heat is applied by means of steam, the proper amount of moisture and the correct temperature being judged by the workman, who is very expert at this particular trade, gauging the temperature and moisture by the feel of the seed in his hand. When the powdered flaxseed is in proper condition the seed passes out under the "former" between two camelhair mats. It is then placed in the presses, the mats being one above the other and when the press is entirely set up a large hydraulic ram forces the mats together, pressing out the oil from the seed.

The material left in the press is the linseed oil cake, and all the surplus oil is found at the edge of the cake. The cake is consequently passed through a trimming machine, which takes off this edge and the cake is then baled up ready for shipment and the trimmings are sent back to go through the process once again. This cake is used largely for a cattle food, and the largest portion of it is shipped abroad to Belgium and Holland.

The oil is then filtered by filter presses, passing through filter cloths, and is now ready to be filled into the barrels. Thus we have our raw linseed oil. The oil at this point, however, is not in proper condition for use by the varnish maker on account of the fact that when heated to a temperature of about 450 degrees F., mucilaginous material, otherwise known as the "Break," separates from the oil. Consequently it is necessary that the linseed oil manufacturers further refine the oil, which is done by means of various chemicals and mechanical devices in order to produce an oil which will meet conditions imposed by their customers. At this point also the various driers are added to the oils in order to prepare the boiled oils found upon the market.

The next oil we shall consider is an oil which perhaps, is not quite so familiar as linseed oil, being our China Wood Oil, an oil made from the nuts of the Tung tree, a tree indigenous to China, growing largely in the interior of China, particularly along the banks of the Yangtse River. These trees bear fruit about the size of a small orange, each fruit containing five segments, each segment containing a kernel. The fruit is roasted over a fire, which breaks open the segments, the kernels separate and these kernels are then placed in the crushing machines.

The Chinese in the olden days used an extremely crude piece of apparatus for crushing these kernels, being nothing more or less than a large stone, which is rolled back

and forth in a trough and crushes the kernels. A more modern crusher consists of a large stone weighing several tons; this is drawn around within the circular trough by means of mules, horses or other animals, and the kernels as they are crushed, gradually move toward the center. It is a very primitive means of carrying out these processes, but it must be remembered that individual Chinamen carry out the process on their own farms and therefore, the machinery cannot be very complex. The powdered China Wood Oil nuts are then tempered and placed between bamboo mats, and heated over a kettle of boiling water until the powdered nuts have picked up sufficient moisture and the mats are then placed edge-wise in the large press. This press also is of primitive style, consisting of large mats, and a large wooden ram forces the logs between which the mats are set edge-wise together, pressing out the oil. The oil is then filtered through bamboo cloths, and is then carried down to the China Wood Oil broker in large baskets, the baskets being lined with a peculiarly oiled paper. Each Chinaman carries four baskets, two being suspended from two sticks swung across the shoulders; each basket of oil which is purchased is tested and its richness determined. The oil is then emptied into the tanks, and from these tanks is drawn off into the barrels, in which it is shipped to varnish manufacturers. China Wood Oil being very different from linseed oil, and in fact, from any of the other oils, we will mention three of its chief characteristic properties. China Wood Oil when allowed to dry by itself on glass, instead of drying with a clear, transparent film as does linseed oil, dries with a cloudy opaque film, very much resembling a piece of ground glass. Secondly, China Wood Oil when heated at a temperature of about 450 degrees F., instead of gradually thickening as does linseed oil, it almost instantly goes over to a solid jelly very much resembling soft rubber. Thirdly, China Wood oil when placed in a bottle and exposed to the light, even though the bottle is air-tight, will, by the actinic rays of the sun be converted to a lard like mass. This last property is very easily overcome by the heating of the oil. The gelatinizing of the oil is also very easily taken care of by proper treatment with various gums, etc. However, the most difficult feature to overcome is that of the "dry-flat," as the varnish maker terms it. This is due to a wrinkling of the varnish film, and I would add it has cost the varnish manufacturer a great deal of money, and they have spent a great deal of time in order to overcome this very serious drawback. However, after years of study the larger manufacturers understand this property thoroughly and have overcome it entirely.

You may ask with all these drawbacks, why it is that the varnish maker should care to use China Wood Oil at all. In the first place, China Wood oil has two important properties which are not found in linseed oil. A varnish made with China Wood Oil will be very much more waterproof than that made with Linseed Oil. In the second place, China Wood Oil has the property of causing the varnish to harden very much quicker than when Linseed Oil is used. These two properties make China Wood Oil a very important and essential feature in certain classes of varnishes. On the other hand Linseed Oil produces in a varnish greater elasticity fuller body and lustre, better flowing properties than can be obtained with China Wood Oil. In producing a varnish, it can readily be seen that it is necessary to utilize each of these oils according to the results desired in the varnish. If, for instance, we desire to produce a spar varnish which must needs have a maximum amount of elasticity in order to stand expansion and



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contraction due to weather conditions, it is necessary for us to use the most elastic materials which we can possibly obtain, consequently Linseed Oil gives us for this purpose the best results. China Wood Oil, on the other hand, when used in a spar varnish attains its waterproof qualities very much quicker upon exposure, will retain a perfect film only for a short period of time after which the film deadens, cracks and makes an extremely poor surface for re-finishing. The Linseed Oil varnish on the other hand while it dries and hardens more slowly and possibly, if rained upon, before it has hardened, will turn white (this whiteness disappearing upon its drying out) yet, at the end of about six months, the film will have worn evenly, and the varnish will have retained a good portion of its lustre.

If we now desire to produce a floor varnish, we must bear in mind that the necessary requisites of a varnish of this kind are that it must be very tough, elastic, waterproof and hard drying. This last property meaning that it must not soften up in warm, humid weather. In designing a floor varnish, we must of course look to the China Wood Oil for our waterproofness and, to a considerable degree, our hard drying properties. At the same time, we must look to our Linseed Oil in order to obtain the maximum amount of elasticity in the varnish film. This latter property is one, which is extremely important and which really determines whether or not a varnish will wear down evenly or whether it will crack and chip. Most people do not realize the amount of stress caused by the impression of heels on a varnished floor, but upon considering this point, you can readily understand that it is necessary to have the maximum amount of elasticity in order to obtain the very best results. Thus, you can realize that in making a varnish for a definite purpose it is necessary to use those properties found in each of these oils in order to obtain a properly balanced product, and this only serves to emphasize the importance of specifying for definite kinds of work the varnish which has been especially designed for that purpose.

A word should be said here regarding the new quick drying varnish, the basic principle of which was discussed in connection with the subject of resins.

During the past year or two, good, bad and indifferent quick drying varnishes have appeared on the market. The same principle described above of properly balancing a product for a definite purpose applies equally well to this new type of varnish. Quick drying products of quality may be had but even in the best of these varnishes there will be found that the practical advantage of rapid drying is at least partially offset by the fact that these varnishes as a class have less body and a greater tendency to skin and gas check.

It must be said, however, that these varnishes have only made their appearance and undoubtedly great progress will be made in the perfection of quick drying varnishes based upon the use of synthetic resins.

We will next take up the subject of Turpentine which is made from the sap, that comes from our southern pine trees. These trees were formerly cut according to the "Box Method;" that is, a box was dug at the base of the tree and the bark then cut from its side. The sap flowed down the side of the tree, ran into the box and was emptied from the box into a basket, then into barrels in which it was carried to the still. Today, however, on account of the fact that this method shortens the life of the tree, undermines its resistance to storms and thus permits great losses, we have perfected what is known as the "Cup and Gutter System." That is, the sap runs down the

side of the tree into a gutter and then from the gutter into the cup, thus the tree is not wounded except on its side, and it is found that the production of sap is greatly increased as well as its quality improved. Furthermore, the trees last a great deal longer and there is not the danger of the entire destruction of forests by wind storm. The sap after being gathered from the tree is then taken to the still, where, a small amount of moisture having been added, it is heated in a large copper retort; the turpentine passes over as a vapor, through coils, is condensed and we have our gum spirits of turpentine. The residue left in the retort is rosin, which is subsequently strained, cooled and prepared for the market.

The material which I have just described is known to the trade as Gum Spirits of Turpentine and it may be well to mention the difference between this product and Wood Turpentine. Gum Spirits of Turpentine is, as I have described, made by the distillation of the sap of the pine tree, whereas, Wood Turpentine is made by the distillation of the wood itself usually utilizing for this purpose, the stumps of pine trees which have fallen. Both of these products are very similar in chemical constitution and in many cases can only be distinguished by their odor. It may be of interest to know that the American Society for Testing Materials in drawing up their specifications for turpentine have adopted a specification to which a high grade of Wood Turpentine can conform based upon the fact that the latter when conforming to this specification is equal in every way to the Gum Spirits. It is important, however, in permitting the use of Wood Turpentine to insist that it conform to such specifications as these, as there are upon the market many grades which have entirely different properties and which should, under no circumstances, be used.

Having discussed the various raw materials used in varnish making, we will now describe briefly the varnish making process.

The gum or resins usually in approximately one hundred-pound lots are placed in a copper kettle, which stands about three feet high and about two and one-half feet in diameter. The kettle is then rolled upon the fire, the gum melted and held there until a certain proportion of the gum has been distilled off. At this endpoint, which is determined by the varnish maker, the melt is drawn from the fire and the oil, which has been heating at an adjacent chimney and which had been previously prepared, is emptied into the kettle. The gum and oil are then thoroughly stirred together, the kettle being run back on the fire and the gum and oil heated until thoroughly amalgamated. This endpoint is also determined by the varnish maker, who has his own particular way of judging as to when the melt is finished and when the batch is completed. The kettle is then withdrawn from the fire and allowed to cool, when it is taken to the thinning room, where the turpentine or other thinners are added. The varnish is then pumped into coolers, where it is allowed to cool to a certain extent before passing to the filter presses, which take out all the dirt. This is done very carefully, in order to take out the most minute particles of dirt and the varnish is then pumped to the ageing tanks, where it is allowed to age for a certain period of time, according to the quality of the varnish.

The question of ageing a varnish is one which has been given a great deal of study, and it has been proven that the ageing of varnish does improve it very considerably, both as regards its brilliancy and durability. This is apparently due to the fact that the various constituents of the varnish gradually become more and more closely knit to-



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gether, which results in the improvement of the varnish.

While the matter of ageing is one, which has, in many cases, been very much overdrawn, yet, at the same time all manufacturers of the highest grade varnishes, even at the cost of tying up their capital, deem it sufficiently important to age their varnishes from one month to twelve months according to the character, grade and composition of the varnish. The completion of the ageing process is determined by tests made upon the varnish itself. After the varnish has been properly aged, it is then pumped to the filling tanks, from which it is drawn into the can or package, which is then labelled, and we have our finished product ready for the market.

ENAMELS

431. In order to cover this subject fully, it will be necessary not only to consider the products that are termed "enamels," but also allied products such as enamel undercoatings, etc. We can, I believe, very logically divide this subject into two parts:

Architectural Enamels. Industrial Enamels.

By Architectural Enamels are understood enamels and allied products which are used for the finishing of high grade work such as is generally found in private homes, etc.

By Industrial Enamels, we mean those products which are used for the finishing of wall work, etc., in factories and industrial buildings of all kinds.

We shall consider first the architectural enamels and at the start state that by an enamel we mean a product made by the combination of pigments and a varnish vehicle so as to form a product such that it may be used as a finishing coat. The American Society for Testing Materials defines an enamel as a special form of paint, which, when spread in a thin film, flows out to a smooth coat and dries to a smooth, glossy, relatively hard, permanent, solid when exposed to the air. An enamel always contains pigment and has considerable hiding power and color. Some enamels dry to a flat or eggshell finish instead of a gloss finish. Generally speaking, we would consider the difference between an enamel and a paint that the enamel is made by the combination of pigment and varnish, whereas the paint is made by the combination of pigment and oils, although there may be drawn, of course, many exceptions to this definition.

Generally speaking, in all cases the method of manufacture is the same—the proper pigments having been selected, they are ground in a varnish vehicle to form a heavy paste. This heavy paste is then reduced with sufficient varnish to make the enamel workable or, in case of eggshell enamels, may be reduced with varnish and additional thinner, or in the case of flat enamels, may be reduced with a thinner such as turpentine or turpentine substitute.

We will not endeavor to describe completely the various pigments which are used in enamels. However, we will say briefly a little as to the principal pigments which are used in white enamels. In all the highest grade architectural enamels, especially those of the gloss and most of the eggshell, the principal pigment is zinc oxide. Zinc oxide is a pigment which comes on the market in various grades, although on high grade enamels, only the Green or the White Seal are considered suitable as pigments for the reason that other grades have not the pure white color which is necessary. Zinc oxide is an ideal enamel pigment for the reason that it is very light in weight and consequently stays well in suspension. Furthermore, it is an active pigment, combining

with the varnish vehicle to form a coat which will have a good lustre and furthermore, on account of its chemical activity, an enamel may be produced which has wonderfully good covering properties. On account of the chemical activity of zinc oxide it is necessary to use a great deal of care in the selection of the varnish vehicle for the reason that when zinc oxide is combined with many varnishes, particularly those with a china wood oil base, the enamel will thicken up and become unsuited for use.

Lithopone is a pigment which is being used today in some enamels, although not in the highest grade enamels, for the reason that it has remarkably good covering properties, has good color and is an excellent pigment. However, it does not tend to combine with the varnish vehicle in such a way as to produce the lustre found in a zinc oxide enamel. It rather has a tendency to dull down the lustre of the enamel, and on account of this tendency has been used very largely in eggshell and flat enamels. Furthermore, considerable difficulty has always been experienced with lithopone in that it has a radical tendency to turn gray in the sunlight, a reaction due to the actinic rays of the sun.

Many other pigments such as Whiting, Asbestine, China Clay, Silica, etc., are being used in many of the flat enamels and flat whites as they are termed, all being comparatively inert and used on account of their price in many cases to cheapen the product, whereas other manufacturers use them for different scientific reasons.

Many manufacturers use Asbestine on account of the fact that it helps suspend the pigment, although any quantity of this material in a paint will hinder the flowing. Other manufacturers use Silica on account of the fact that it assists in the flowing, and where a considerable quantity of zinc is used does increase the durability and the tenacity of the material. Whiting is used many times to increase the flowing properties of a paint and China Clay is also used for this reason, and in order to improve the working properties of the product.

An enamel product should be judged more by what it does than by its composition, for manufacturers are learning today that many of the pigments which were held as adulterants a few years ago really have good reason for being in high grade enamel and enamel products and the architect in specifying enamel will do far better to consider the service that an enamel will give rather than its actual composition.

Eggshell and flat enamels are usually manufactured by using a sufficient quantity of pigment so that the pigment predominates over the varnish vehicle in such a way that the pigment comes to the surface, so to speak, and gives the semi-gloss or dull effect. Other eggshell and flat enamels are produced by the use of a vehicle such that it in itself has a tendency to dry out with a semi-gloss finish, which process does not necessitate the use of so much pigment and is really a more reliable product.

The subject of Undercoatings for use with enamels is one which is really covered by the subject of flat enamels in that an enamel carrying a large amount of pigment and having as good flowing properties as is possible, drying out either flat or with a slight sheen and manufactured in exactly the same way as is described above under the subject of flat enamels, is what is termed undercoating.

However, for architectural work, two kinds of undercoating are generally marketed—a regular enamel undercoating such as would be used on wood surfaces and an undercoating designed especially for use on cement, brick, etc., where it is necessary to use a special undercoating to resist the alkali in cement. Undercoatings of the former type

PLAIN AND DECORATIVE PAINTING.

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are usually made on a lithopone base, whereas undercoatings for use on cement should be made on a zinc base, for zinc combined with a varnish vehicle produces a material which is very resistant to the alkali.

In undercoatings as in enamels the architect should, to my mind, refrain from specifying the composition of the material, but specify as to what the material shall accomplish.

We should at least mention the new quick drying four hour enamels which undoubtedly will be used and specified more and more by architects, particularly, in the colors. These enamels are manufactured upon the same general principle as the enamels described above but the vehicle is a varnish manufactured by the use of a synthetic resin and, consequently, imparts very quick drying.

Up to date it has not been possible to produce a white enamel of the same degree of whiteness as the long oil type enamel, but undoubtedly progress will be made along this line. These quick drying enamels do not have quite the fullness of body of the straight oil type, but their quicker drying coupled with sufficient durability for all practical purposes will undoubtedly make them very acceptable to the painting fraternity.

Passing from the subject of Architectural Enamel, we wish to say a few words on Industrial Enamel, or what are commonly termed "mill whites."

These products are usually of three kinds:

Gloss.
Eggshell.
Flat.

The flat is used as an undercoating with the gloss and eggshell. In all three of these

materials, lithopone is usually used as the basic pigment. The predominating feature in these products is the permanency of the white. That is, the ideal is a mill white which does not turn yellow upon standing. Generally speaking, these products are not made with the same degree of care as architectural enamels. In many cases the grinding is not done as carefully and the lustre of the gloss enamel is seldom as high or as permanent as with the architectural enamel.

A very important feature with an industrial enamel is its working properties.

On account of the high cost of labor, usually only two coats are recommended for industrial work, although it is an established fact that far better work would be secured if three coats were used, so as to enable the use of a primer, especially on new work. However, practice has established that two coats is sufficient and two coats are generally specified.

One exception to this is the finishing of new concrete and cement where it is absolutely necessary for a special coating to be applied as a primer before the undercoating and enamel, if work of a permanent nature is to be secured, for the reason that otherwise, free alkali will attack violently the mill white and cause disintegration and discoloration in a very short time.

The above does not treat in any great detail of these various products, but we trust it will be of assistance to architects in making specifications, and in concluding I wish to particularly call their attention again to the fact that in specifying an architect should look to the service which a product gives rather than to the actual chemical analysis.

VITROLITE



The above illustration shows a recent installation of Vitrolite in the Barber Shop in the Union Carbon and Carbide Building, Chicago, Ill. Note the delicately etched, fluted columns in dark green, combined with light green panels and black base. This classical, two-tone green design illustrates the modern and sanitary effect that Vitrolite produces. Architect, D. H. Burnham & Co., Chicago.

To the right is shown the lobby in 18 South Michigan Avenue, Chicago. This Vitrolite installation is typical of the unusual and attractive modern design in tones of black obtainable with this fused-rock material. Architects, Cowles and Colean, Chicago.



Above is pictured the "Vitrolite Bathroom" in the C. H. Langer apartment, Powhatan Apartments, Chicago, Ill. The many color combinations, including black, and the flexibility for design is causing architects all over the United States to specify Vitrolite. Robert De Golyer, Architect for Powhatan Apartments.

To the left is shown the very modern toilet room in the Administration Building of the Jewel Tea Company, Barrington, Ill. Black Vitrolite and silver tinsel paneling make possible this very attractive treatment.

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GLASS AND GLAZING

Glass making is one of the oldest known crafts, and its origin is lost in antiquity. However, it is only in comparatively modern times that glass has been recognized as a highly useful product, and has been made for purposes other than ornamentation. Although blown glass had been manufactured for some time previously, it was not until the 17th century that a process of manufacturing cast glass was developed in France from which the present method of making plate glass has been evolved. Present day large scale production of plate and window glass has been made possible by mechanical improvements perfected within very recent years. Blown glass was made on a small scale in the settlement of Jamestown, Va., about 1608, but it was not until 1860 that the first cast plate was produced in this country. The intervening seventy years between then and now were a long uphill struggle against foreign competition and technical difficulties, and the greatest improvements in manufacturing methods have been made within the last two or three decades. Present day glass manufacturing is one of the most modern of industries.

PLATE GLASS.

Manufacture.—Plate Glass is the finest flat glass made, and its superior quality is derived from its painstaking process of manufacture. The distinctive quality of Plate Glass is its perfectly flat parallel surfaces which insure clear, undistorted vision. As will be seen, the most difficult and laborious part of plate glass manufacturing—the grinding and polishing process—is directed toward the attainment of this result. The ingredients of Plate Glass are practically the same as those of Window Glass, the difference in the finished products being due to the more elaborate process of casting, grinding and polishing plate glass in contrast to the comparatively simple method of producing window glass by drawing it vertically upward in a flat sheet from a tank of molten glass. The principal ingredients of the melting batch are silica (white sand), soda, lime, and salt cake, to which are added proportionately small amounts of arsenic, charcoal, and cullet (broken glass).

At the present time, plate glass is made by one of two methods; it is either melted in a pot and cast, or it is melted in a huge tank from which it flows out through rolls. Both these processes are described briefly below:

Pot Making.—The pots of fire-clay in which the materials are melted together and fused, play such an important part in the successful manufacture of cast plate glass that the subject of pot making deserves special notice. The fact that it requires several years to make a pot, but that it lasts only a few days in service, entails a heavy expense in the manufacture of cast plate glass.

The clays used in making the pots are exposed to the weather for a period of from one to two years, so that they will become thoroughly seasoned. They are then ground and screened and the finely sifted raw clay is mixed with coarse burned clay and water. The addition of burned clay reduces the liability of shrinking and cracking. The mixture is then kneaded and stored for about six months to ripen.

The pot itself is made by hand by highly skilled workmen, as the slightest defect, such as an air cavity, would cause the pot to crack in the furnace. The finished pot is then stored for from six months to a year for its final seasoning. Each pot holds a ton and a half of glass, and weighs 3,000 pounds. The average pot will cast approximately 600 sq. ft. of glass. The pots must be able to withstand a temperature of 3,000 degrees Fahrenheit as well as sudden changes in temperature. The life of the average pot, even after the greatest care has been taken in its manufacture, is only twenty days.

Melting and Casting.—Plate glass is melted in large gas heated furnaces which hold from twelve to twenty pots. A temperature of from 2,500 to 3,000 degrees Fahrenheit, for a period of 24 hours, is required to complete the melting. During this process the pot must be filled three times to insure a full pot of molten glass, as the intense heat causes a shrinkage of the raw materials. When the melting has reached an exact point, the pot is lifted from the furnace by huge electric tongs and taken to the casting table.

Until the last few years, plate glass was cast on a large rectangular metal table, and this method is still employed in making unusually large or thick plates. The contents of the pot were emptied on the table and flattened by a steel roller weighing twenty-five tons, making an enormous molten sheet about half an inch thick. This sheet was then shoved into an annealing oven, known as the "lehr," to prevent sudden cooling and consequent cracking. The lehr consists of a series of ovens, each succeeding one being slightly lower in temperature, through which the cast plates are shoven to insure gradual cooling.

The present method of casting plate glass, developed very recently, is slightly different from this procedure. The molten contents of the pot are now cast between two moving rolls which produce a sheet more uniform in thickness than the old process. This sheet immediately enters the first oven of the lehr and is cooled gradually until it emerges at the other end of the lehr, a large sheet of rough glass.

Tank Glass.—One of the most radical mechanical improvements in the manufacture of plate glass is the tank or continuous process. This method eliminates the necessity for pots and does away with the casting process. The raw materials are melted in a huge tank

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lined with fire clay or refractories, which is kept at a constant high temperature. At intervals additional quantities of raw materials are added to keep the tank full. A constant stream of molten glass flows from one end of the tank through rollers into the lehr. This continually moving ribbon of glass, passes slowly through the lehr and is cut off in the proper lengths at the cool end. In spite of the apparent simplicity of this method compared with the more laborious pot method, it is a triumph of modern engineering skill.

Grinding and Polishing.—The three processes of making plate glass described above all produce about the same kind of material—large plates of rough glass having no resemblance to the fine, highly polished plate glass to which the layman is accustomed. Although the rough glass is flawless and has the same inner transparency as the finished product, it remains for the grinding and polishing process to bring out its hidden quality and make it distinctively plate glass.

The rough plates are placed on flat topped steel cars and set in plaster of paris to keep them from slipping. Formerly the plates were placed on large revolving tables, but grinding and polishing is now a continuous process and literally, train loads of rough glass are constantly passing through the grinding and polishing machines. The cars are coupled together so that a continuous ribbon of glass is being ground and polished at the same time.

Grinding is done by means of massive iron-shod runners which revolve over the surface of the glass. Water and sand are fed under the runners as they revolve, and under this powerful abrasive action, the surface is ground with absolute uniformity until all the irregularities in the rough glass are removed. As the ribbon of glass passes farther along under the battery of grinding machines, finer sands are substituted for the coarser grades until, during the final stages, a still finer abrasive—emery—is used in several degrees of fineness. The glass is then washed and the cars continue on to the polishing machines.

Polishing is similar to the grinding process, but instead of iron runners, the polishing machines are equipped with buffing disks of felt. Red oxide of iron, commonly called rouge, the finest known abrasive, is fed under the buffing disks as they revolve. This polishing process gives plate glass its beautiful brilliant surface.

After one side of the plate has been ground and polished, it is reversed and the process is repeated on the other side. Grinding and polishing reduces the plates to their proper thickness and it involves considerable loss of material as a large amount of the glass is ground away. The finished plates are inspected carefully for defects and cut to proper sizes.

Sizes.—On account of the extraordinary demand for certain sizes of plate glass for stock sizes in mirrors, windshields and windows for

automobiles, and stock door glazing, the proportionate production is below the consumption and a higher value is therefore placed on these sizes and their multiples. Polished plate glass in regular $\frac{1}{4}$ " thickness, which has a latitude from $\frac{3}{32}$ " to $\frac{5}{32}$ ", can be made in very large sizes over 200 square feet in area. Plates as large as 144" x 240" (or 12 feet by 20 feet) containing 240 square feet have been made. However, such extraordinary sizes are very difficult to make, expensive, and dangerous to clean and handle. They are especially made to order, entail considerable delay in replacement when broken, and require special flat car shipment and special facilities for unloading and handling, as well as the most expert and skilled glaziers in setting. It is advisable, therefore, to confine the sizes of the plates required within the limits of 122" x 194". Prompt and economical deliveries of plates within these limitations may be secured from distributors' stocks. It is customary to measure glass sizes in inches, specifying the width first, then the height.

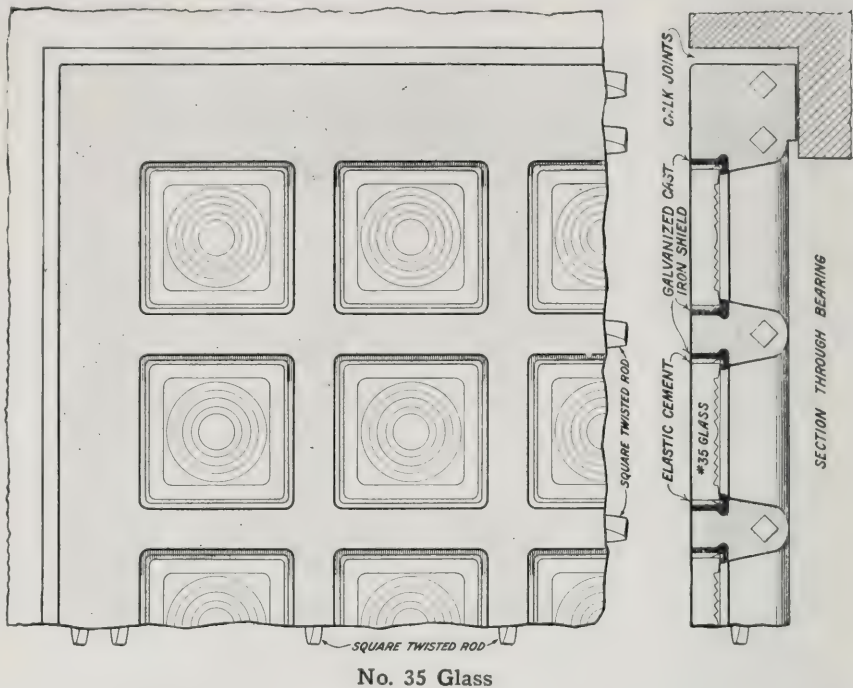
Thickness.—Although polished plate glass is manufactured in thicknesses ranging from $\frac{7}{64}$ " to $1\frac{1}{2}$ ", the standard produce is known as $\frac{1}{4}$ " plate and is allowed to run from $\frac{3}{32}$ to $\frac{5}{32}$ of an inch thick. The other thicknesses are made specially and at an increased cost. The sash or rabbet for regular plate glass glazing should be made to accommodate glass full $\frac{3}{32}$ of an inch thick.

Thin plate, $\frac{7}{64}$ "—seven sixty-fourths of an inch plate glass—generally termed $\frac{1}{8}$ " plate for convenience, is used wherever perfect surfaces, high polish and absolutely clear vision are required with minimum weight. It is particularly suitable for residence windows as no special sash is needed.

Plate glass thicker than the standard product is used for counter tops, deal plates, port and deck lights on ships and aquariums. It is made in thicknesses of $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{5}{8}$ ", $\frac{3}{4}$ ", $\frac{7}{8}$ ", 1", $1\frac{1}{8}$ ", $1\frac{1}{4}$ ", $1\frac{3}{8}$ ", $1\frac{1}{2}$ ".

Qualities.—Plate glass is made in four qualities ranging from the finest mirror or silvering quality to regular glazing quality. Quality is determined by the number and seriousness of defects in a plate, and the type of polish given to the surfaces. Regular glazing quality may contain some defects which in no way impair the value, beauty, or durability of the glass for ordinary use, such as small seeds or bubbles, short finish, ream or surface scratches, which are accepted as contingent with the regular run of plate glass, and even an open bubble or shot-hole (not clear through both surfaces) is passed in glazing quality, providing the plate is comparatively free from other defects and of good color and finish.

Weight.—Plate glass in regular thickness ($\frac{3}{32}$ " to $\frac{3}{16}$ ") weighs approximately 3 pounds per square foot bare, and its weight boxed for shipment may be roughly computed at 5 pounds per square foot. An easy method of figuring the approximate shipping weight of plate glass is as follows:



SPECIFICATION

Sidewalk Lights to be of reinforced concrete construction glazed with No. 35 POLARISCOPE TESTED GLASS set in GALVANIZED CAST IRON SHIELDS with SPECIAL ELASTIC CEMENT all as made by RICHARDS & KELLY MFG. CO., 311 West Twenty-third Street, Chicago, Ill.

Manufacturer to furnish free of charge f.o.b. factory glass units for replacement of broken glass for a period of five years.

Manufacturer to give written guarantee to maintain construction against defective materials and workmanship for a period of one year from date of installation.

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CHICAGO, ILL.

Manufacturers of Reinforced Concrete Sidewalk Lights
Reinforced Concrete Roof Lights
Sidewalk Doors · Coal Hole Covers

Extend the glass at 3 pounds per square foot. The weight of the box equals the square foot area of a plate of the greatest width and length of those packed therein, multiplied by 10. Thus:

1 plate 36" x 96" } =59 sq. ft. x 6 =177 lbs.
1 plate 60" x 84" }
Size of box—60" x 96"—40 sq. ft. x 10=400 lbs.

Total weight of shipment=577 lbs.

Edgework.—The value of plate glass for furniture tops, desks and tables, show-cases, shelves and numerous other purposes is generally recognized. The glass covering offers a clean, sanitary surface, and in addition to protecting and preserving the furniture, the highly polished surface of the glass enhances its appearance. For most of these purposes the edges of the plates must be polished—a process requiring considerable skill. The edges of plate glass may be polished to almost any specifications—they may be rounded, made square, or beveled to any desired width. The process of grinding and polishing the edges, or rounding of corners, curves or pattern lines may be roughly divided into five operations as follows:

Roughing is done on a large cast-iron wheel about 30" in diameter, having a corrugated surface which revolves rapidly in a horizontal plane. Either sand or carborundum mixed with water is used as an abrasive. The edge of the plate is brought in contact with the wheel until the proper amount of glass is ground off. Curved plates and those cut to pattern require great skill on the part of the operator.

Emerying is done on another wheel to remove the deep lines cut in the edges by the coarse sand. Finer abrasives such as emery or fine carborundum are used.

Smoothing is done on a circular revolving sandstone of fine texture over which water flows to reduce friction, where the rough grinding is smoothed still farther.

Polishing is first done on a wood wheel by the use of powdered pumice in solution. This process gives the edge a dull, milky polish.

Finishing is done on an upright, felt covered wheel by the application of rouge. This process gives the edges their final high gloss polish.

Beveling is done in the same manner as grinding and polishing the edges, except that the work is done on the surface of the plate at an angle instead of on the edge. Beveling may be done to any required width, but the standard is 1".

Slight scratches may be removed from the surface of plate glass by rubbing with pure thick felt mounted on a hand-block and using fine red or black rouge moistened as an abrasive. This must be done skillfully to avoid over-polishing or "burning" the delicate annealed surface of the plate.

Wheel-cut Mitred Work.

For decorative effects on door-plates, side-lights, transoms, and partition glass, the rich effect of mitred design gives a tone of elegance, and emphasizes the beauty of the glass. The lines are cut V shape into the surface of the glass by a vertical wheel with sharp edges, and the smoothing and polishing is accomplished by the same general process as on the edging and beveling described above. Mitred designs on plate glass mirrors or on rolled figured glass produce an attractive effect where special and more elaborate decoration is wanted.

WINDOW GLASS.

Manufacture.—The modern method of manufacturing window glass by drawing it flat in a continuous sheet is a radical improve-

ment over the old method of blowing and flattening cylinders by hand. The method in brief is as follows:

The raw ingredients (or batch) are melted in a large tank lined with fire clay (or refractory). From this tank the glass is drawn vertically upward to a continuous flat sheet, through annealing ovens to be cut off in finished sheets of the proper length. Although this process sounds quite simple, it has required years of experience in window glass manufacturing and a vast amount of technical research to perfect. The results of this new process have been a revelation in the window glass industry. There are no more the uneven thickness, surface burns and stringy, wavy effects so long associated with window glass. Instead, flatness and brilliancy are achieved which never before were believed possible in fire finished glass. As either surface is equal in quality and the glass is no longer bowed, either surface may be glazed outward—thus eliminating a precaution which was necessary in glazing the old blown window glass.

Sizes.—Window glass in all thicknesses, except the unusually thin picture glass, is made in sizes up to 60" x 80". Picture glass is made in sizes having a maximum length of 40".

Thickness and Weight.—The thickness of window glass is generally measured by the number of lights contained in one inch, and a small variation is allowed either way. Picture glass measured approximately 13 lights to the inch and weighs about 16 ounces per square foot. Single strength measures from 10½ to 11 lights to the inch and weighs from 21 to 22 ounces per square foot. Double strength measures about 8 lights to the inch and weighs approximately 26 ounces per square foot. The "39 ounce" grade of heavy window glass runs approximately ⅝" in thickness. Heavy window glass in the ⅝" thickness weighs about 45 ounces per square foot.

Qualities.—There are three general classifications for grading the quality of regular single and double strength window glass as follows:

A.A.—The best quality obtainable in window glass. Higher than a commercial necessity.

A.—The highest grade for special commercial uses. Contains no defects to perceptibly interfere with straight vision.

B.—Glass free from glaring defects—but containing such imperfections as prevent its being graded as "A.A." quality or "A." quality.

Picture glass is made in superfine, select and commercial qualities which correspond approximately to AA, A, and B qualities as above, respectively. Heavy window glass is obtainable in two qualities, auto and select.

Packing.—Window glass is packed in regular sizes approximately 50 square feet to the box up to the 100 united inch bracket (obtained by adding the width and length), and 100 square feet to the box in sizes over 100 united inches.

Shipping Weight.—Single strength in factory packages weighs from 65 to 75 pounds to the box (shipping weight.) Double strength in factory packages weighs from 85 to 110 pounds to the box, 50 foot boxes (shipping weight). Double strength in 100 foot cases weighs approximately 225 pounds.

Ultra-Violet Ray Transmitting Window Glass.—Various types of window glass, known as ultra-violet ray transmitting or "health ray" glasses are now made. These glasses transmit various portions of the sun's ultra-violet rays which are recognized as being of therapeutic value, but which are shut out by ordinary window glass. They are particularly suitable for windows in hos-

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pitals, schools and public institutions, as well as for sun room windows in private residences. Such glass is made in three types—clear, transparent; semi-obscure; and wire. The buyer of such glass should be careful to pick a brand which is recognized as transmitting a large proportion of the sun's ultra-violet rays in what is generally admitted to be the vital or health giving range.

WIRE GLASS.

The use of metal frames, metal window sash and fire-proof construction has increased the demand for wire glass, until the production of this material amounts to millions of square feet annually. Not only does this glass minimize the fire hazard, but its resisting and sustaining strength, its unyielding qualities even when cracked, make it the logical glass for skylights, elevator shafts, and stairwells, where these features are an important consideration.

Manufacture.—Wire glass is made by three methods: (1) Shuman process—by rolling a sheet of glass, laying the wire mesh upon it while the glass is still plastic, pressing the wire netting into the glass, and by a coincident process smoothing the surfaces. (2) Appert or Schmertz process—by rolling a thin sheet of glass and laying the wire mesh upon it and simultaneously pouring and rolling a second sheet of glass on top, embedding the wire. (3) Continuous or solid process—by mechanically crimping the wire netting and placing it on the casting table and pouring and rolling the glass over it to produce a sheet of wire glass. Various types of obscure and figured glasses (described in the next section) are made both plain and with wired construction.

Sizes and Thicknesses.—Wire glass is made in sheets as large as 50" x 130". The standard thickness is $\frac{1}{4}$ ", which has been approved by the National Board of Fire Underwriters. Other thicknesses are $\frac{3}{16}$ " and $\frac{1}{2}$ " as well as $\frac{3}{8}$ " or heavier for special purposes.

Underwriters' Requirements.—It is necessary to follow certain rules and regulations in the making of fire-proof windows and construction, as provided by the National Fire Protection Association, and a copy of the requirements of the National Board of Fire Underwriters may be obtained from any member of the National Glass Distributors' Association.

Extracts from "Regulations of the National Board of Fire Underwriters for the Protection of Openings in Walls and Partitions Against Fire"

Effective October 15, 1930.

5212 "Size of glass for fire windows.—Area of wired glass between supports shall not exceed 720 square inches, and the longer dimension of the glass shall not exceed 54 inches."

5214 "Glazing Fire Windows.—(a) Windows shall be glazed with standard $\frac{1}{4}$ -inch wired glass fitting the provided glass opening as closely as possible. The clearance between the edges of the glass lights and the metal forming the glass opening usually varies between $\frac{1}{8}$ " and $\frac{1}{4}$ " depending on the size of the glass. Glass shall be held in place and be mechanically secure without depending on the putty which is for weatherproofing only."

There are also restrictions and regulations governing the depth of rabbet, bearing of glass and style of metal frames and sash to meet the demands of fire retardant construction and to permit reglazing.

OBSCURE GLASS AND GLASS WITH PATTERNED SURFACES

Several kinds of glass are now manufactured which will admit light without permitting vision. These glasses are particularly

suitable for partitions, doors and transoms in private offices, corridors in buildings, windows which face other windows or an unwanted view, as well as for other uses of a purely ornamental character.

Ground or Sandblasted Glass is made by blowing sand against either or both surfaces of the glass with compressed air, which gives it a frosted appearance. The sandblasting may also be done on only part of the plate or in designs and lettering.

Single and Double Process Chipped Glass is obtained by coating the surface of the glass with strong glue which, on drying, tears off thin flakes of glass and produces a delicate tracery pattern. When this process is repeated, in making double process chipped glass, a still more effective design results. Chipping may also be done only on part of the plate or in accordance with a pattern.

Tapestry Glass is a new type of obscure glass having an unusually fine texture of surface. Its ease of cleaning, excellent diffusive properties, and attractive appearance, make its uses practically limitless. This glass is made in both $\frac{3}{16}$ " and $\frac{1}{4}$ " thickness in sizes up to 72" x 150". Both thicknesses are made with the tapestry finish on both sides, and the $\frac{1}{4}$ " thickness is also made with one side polished.

Rolled Figured Glass is a cast glass which, instead of being ground and polished, is impressed on one side with a more or less ornamental pattern. These patterns are essentially prismatic, and as such serve to diffuse and distribute light. This type of glass is made in a wide variety of designs which, while admitting all the light, afford privacy and have excellent decorative possibilities. As mentioned above, some types of this glass are made with wired construction. Also several types are made with the smooth side ground and polished.

Embossed Glass and Etched Glass are produced by treating the surface with hydrofluoric acid. Embossed glass is translucent without being transparent, and has a delicate satin-like finish, similar to fine sandblasted glass. Etched glass is made in the same way in an endless variety of patterns.

Bent Glass.—All of the types of glass described in this article can be furnished in bent shapes. Wire glass, however, can only be made in the more simple bends.

Prismatic and Diffusing Glass.—Prism glass and diffusing glass is made in sheets by the rolled process and in smaller units by the pressed process. In sheets this glass is obtainable in sizes up to 60 inches high by about 120 inches long in the plain, and in slightly smaller sheets in the wired.

In pressed glass the units usually vary from 4 inches to 6 inches either in square or some geometrical shape, and these units must be built in metal frames to required sizes to fit openings.

Thickness varies in both sheet and pressed glass from approximately $\frac{3}{16}$ " to $\frac{1}{4}$ " inch and shipping weight may be computed at from approximately 3 pounds per square foot for plain glass to 5 pounds per square foot for wired or metal glazed units.

There are several standard makes of prism glass as well as a very few standard and recommended designs of obscuring and diffusing glasses obtainable and it is especially desirable that careful consideration be given the selection and specification of a design of prism or diffusing glass best suited to give the desired results, depending upon the location and the conditions surrounding the openings in which the glass is required.

MIRRORS.

Any imperfections of the glass used in making mirrors are magnified and accentuated

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to a considerable degree by the silvered surface, and it is consequently necessary to use the finest grade of plate glass to secure good mirrors. Glass for mirror purposes must be selected with the most scrupulous care. Every consideration must be given to both surface and general character, as the ordinary defects which would otherwise be unnoticed, are brought out sharply by the silvering.

Silvering.—The formula of the silver solution for making mirrors varies but slightly with the different makers. The secret of success is in the process and manner of treatment. Cleanliness is absolutely necessary. Chemically pure ingredients, distilled water and expert care with the proper facilities will produce mirrors which will stand for years without deterioration.

After a thorough cleansing of the glass which removes all foreign substances from the surface, the "solution" is poured over the plate, and a coating of pure silver is deposited by chemical precipitation. This is permitted to dry after which a preservative coating of shellac, and a coat of special mirror-back paint complete the process. The resulting mirror is known as a patent-back mirror, and is the standard highest grade.

Sizes and Thickness.—The sizes of polished plate glass mirrors are limited only by the sizes in which it is possible to make plate glass, and thin or heavy glass may be used as desired. However, it must be remembered that extreme sizes in strictly clear plate of mirror quality are difficult to obtain, and necessarily carry some ordinary technical defects, which cannot be entirely eliminated.

Copper-Back Mirrors.—A new process has lately been introduced in mirror manufacturing known as copper-backing, which produces a mirror very much superior to and much more durable than ordinary patent-back mirrors. Copper-back mirrors are made the same way as any fine plate glass mirrors, except that, in addition, a layer of solid copper is deposited on the silver coating by an electrolytic process. This provides an impervious insulation, protecting the sensitive silvering from dampness and chemical reaction, and making the backing of the mirror more resistant against handling abuse. The delicate film of silver is completely protected by a sheathing of copper.

Copper-back mirrors are made in sizes up to 72" x 142".

Shocks.—The common sheet-mirror or looking-glass, used principally for the reflection of light rather than detailed images, is known to the trade as a "shock-mirror," and is made from ordinary window glass.

Installation.—Standard patent-back mirrors are susceptible to the effects of extreme cold or heat and moisture, and should be mounted with proper protection against dampness. An air space should be left between the mirror and wall, and care should be taken to avoid damp walls or plaster which has not properly dried out, before installing mirrors.

In glazing French doors with mirrors, or on Colonial work where small mullion glazing is specified, it is essential to have the panels on an absolutely uniform line, and rabbets of accurate depth, as the mirrors will otherwise reflect at different angles, resulting in distortion. A good effect may be obtained by using a large size mirror for a background with a false mullion over all.

GLAZING.

It is especially desirable that all glass to be specified for a building be placed under one section in the architect's specifications under the heading—"Glass and Glazing."

Accuracy is a necessity. Use a standard rule, to gauge, specify the size plainly.

For instance 56 inches might be confused if written 5' 6", and cut 66 inches—as 5 feet 6 inches. Always specify width first. In measuring, it is advisable to allow a little play and measure inside the rabbet. See that rabbet is made to accommodate glass of the thickness ordered; i. e. order glass of proper thickness to fit rabbet. Measure the opening and see if all sides are squared, especially if metal work is to be glazed, it is essential to have perfect fit, and in large sizes it is not uncommon to find a warped frame, or not exactly square, slightly different at one side as compared with the other.

Be specific—it is better to give an abundance of information rather than leave anything indefinite, or to be taken for granted. Mistakes will follow carelessness and corrections involve loss of time and expense.

Large lights of plate glass should rest on two pads of felt, leather, lead, oakum or soft wood blocks, one near each end, not against bare metal, or at a single bearing-point which might cause breakage through settling of building, vibration, etc. The soft wood blocks or lead strips are to be preferred.

Do not fasten or bind glazing-mouldings too tight, as it is necessary to allow for expansion and contraction, vibration and readjustment of construction.

Use pure putty. Have sash-rabbet well oiled or painted so that putty will adhere. Give fresh putty glazing time to set before handling or hanging sash. Don't try to back-putty glass with corrugated or figured surface, as the putty cannot be removed from the ridges of the glass.

Steel sash glazing requires special putty for metal rabbets.

Caution.—When glass of any kind has been delivered to a building packed in cases or with paper between the sheets, it is advisable to store the glass under cover in a dry place and unpack it to avoid stains which come from drying out of damp hay, straw, paper, or other packing materials.

Glaze prism-glass with ribs inside—flat surface outside. Regular glazing is done with uncolored putty. If colored putty is desired, it should be specified accordingly. Glass is not bedded-in-putty or back-putted unless specially ordered or specified.

METAL STORE FRONT CONSTRUCTION.

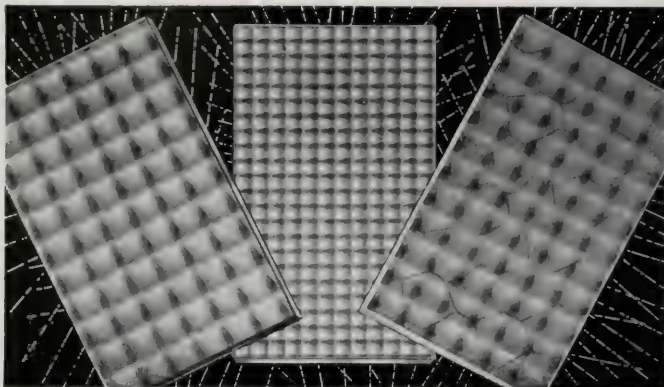
The use of metal corner-bars, division bars, sash and sills and the all-glass show-case or show-window has become so universal that few old-fashioned stores remain and all modern construction is marked by the absence of bulky posts or ponderous frames.

There are several standard makes of metal store-front construction, corner-bars, dividing bars, metal sash and sill, which fasten or secure the glass with a metal locking or clamping member and provide for drainage, ventilation and illumination if desired.

It is well to give attention to the necessity for substantial strength in the retaining members and to using metal bars and construction of sufficient weight to insure strength and rigidity, and to avoid the use of the metal covered mouldings as a substitute for the all metal construction.

It is advisable to send working drawings or detailed plans of store fronts—and the utmost care should be exercised in furnishing accurate dimensions when ordering, so that a true fit of metal may be assured and proper allowance made for bearing contact or play of glass.

The architect should make definite specifications as to the material desired, giving names or numbers of bars, sill covering jamb bars, jamb covering, transom bars, transom covering and style of metal finish.



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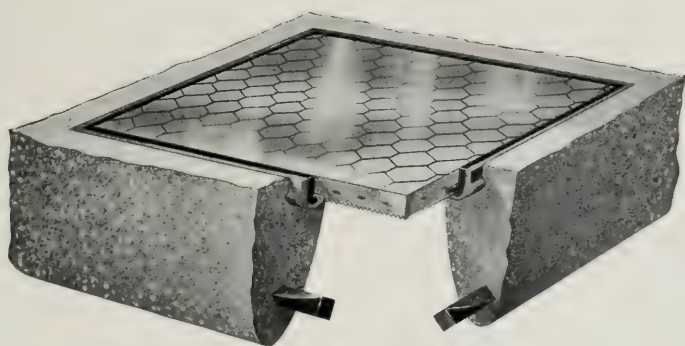
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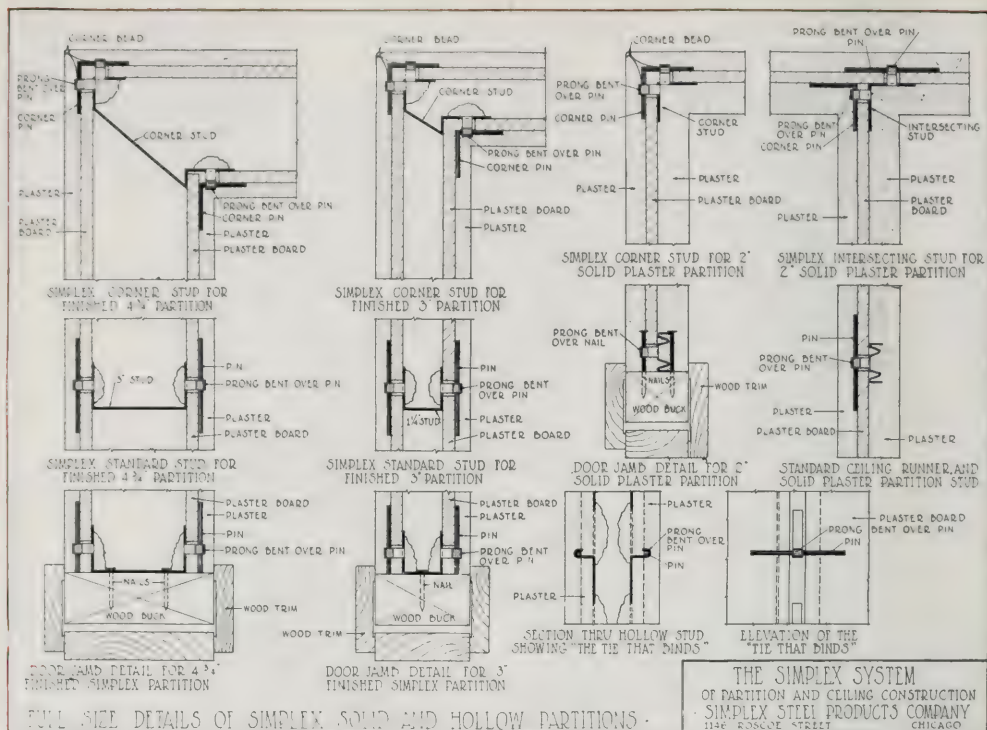
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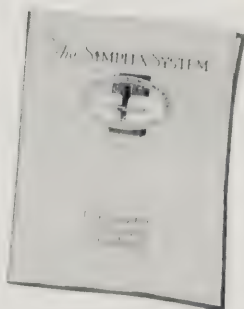
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STANDARD RULES OF THE MEASUREMENT OF PLASTERING.

Adopted by the Employing Plasterers' Association of Chicago.

LATH AND PLASTERING

to be measured by the superficial yard, from floor to ceiling for walls, and from wall to wall for ceiling.

In rooms containing one or more horizontal angles between the floor and ceiling line, the ceiling to be measured from wall to wall, as though all walls were vertical, for contents of ceiling, and from floor to highest point of ceiling for height of wall.

OPENINGS.

Openings in plastering to be measured between grounds. No deductions to be made for openings of two feet or less in width. One-half of contents to be deducted for openings two feet or more in width. The contents on all store front openings to be deducted, and the contractor to be allowed one foot six inches for each jamb by the height.

All beams or girders projecting below ceiling line to have one foot in width by total length added for each internal and external angle.

No openings to be deducted from "solid" or "hollow" metal lath and plaster partitions nor for openings in suspended ceilings containing less than 100 square feet, where furring is carried around such openings by plasterer. No openings to be deducted from cement wainscot or base.

CORNER BEADS, ARCHES, ETC.

All corner angles of more or less than 90 degrees, beads, "bullnoses," quirks, rule joints, and moldings, to be measured by the lineal foot on their longest extension, and one foot for each stop or miter.

CORNICES.

Length of cornices to be measured on walls. Plain cornices of one foot girth or less to be measured on walls by the lineal foot. Plain cornices exceeding one foot girth to be measured by the superficial foot. Add one lineal foot to girth for each stop or miter. Enriched cornices (cast work), by the lineal foot for each enrichment.

Arches, corbels, brackets, rings, center pieces, pilasters, columns, capitals, bases, rosettes, bosses, pendants and niches by the piece. Ceiling or frieze plates over eight inches wide by the square foot.

COLUMNS.

All columns to be measured by the lineal foot for plain plastered columns.

CEMENT WAINSCOTING AND BASE.

All cement wainscot to be measured by the square foot, and cement base by the lineal foot.

GROUND.

All grounds for various classes of work to be as follows, unless expressly specified to the contrary:

Grounds for 3-coat lath work.....	1 inch
Grounds for 3-coat metal lath work.....	5/8 inch
Grounds for 3-coat metal lath work, on 1/2-inch iron furring.....	1 1/2 inch
Grounds for 3-coat metal lath work, on 1-inch iron furring.....	1 1/2 inch
Grounds for hard mortar metal lath work.....	5/8 inch
Grounds for hard mortar metal lath work, on 1/2-inch iron furring.....	1 1/2 inch
Grounds for 2-coat work on brick or tile.....	5/8 inch
Grounds for hard mortar on brick or tile.....	5/8 inch
Grounds for hard mortar lath work.....	1 inch
Grounds for plaster board.....	1 inch

Where metal lath is spoken of it applies to all wire or metal lath.

The Employing Plasterers' Association of Chicago solicit the co-operation and support of Architects and others in the Association's efforts to set the highest standard possible for plastering.

In many of the branches of building construction, efforts are tending towards the use of better material and workmanship, no material or finish for a building combines so fully the essentials for fire protection and sanitation at so low a cost to the owner as does plastering, and no other material that enters so largely into the construction of a building presents so large an area of visible surface as does plastering. The cost of plastering represents only a small percentage of the total cost of a building.

It is a necessary base for the most expensive decorations and in itself provides the requisites necessary for a finish interior. The association believes that so important an element in the construction and finish of a building is worthy of being well done, and that the best workmanship and material if specified and called for will more than compensate owners and architects in their requirements for such grade of work. The Employing Plasterers' Association of Chicago respectfully submits the following outline specification for lath and plaster work; all trade names of material have been omitted. Architects will find a list of standard materials in the Hand Book and elsewhere.

TENTATIVE OUTLINE SPECIFICATION FOR LATH AND PLASTER WORK.

Sand. All sand to be clean, sharp sand.

Lime. All lime to be fresh burned lump lime or an approved quality of Hydrated lime.

Lath. All wood lath to be No. 1 white pine 1 1/2" lath free from sap and bark and even edged.

Nails. To be 3 penny fine 16 gauge wire nail.

Wire Lath. To be No. 18 Washburn and Moen gauge .0475" mesh painted or No. 24 gauge metal lath painted with ribs not less than 1/8" wide, lath cut from sheet metal shall weigh not less than 3.4 lbs. per square yard.

Stucco. To be fresh.

Hair. To be well whipped cattle hair.

Fibre. To be long vegetable fibre.

Portland Cement. To be a brand that shall meet the requirements of the standard specifications for Portland Cement of the American Society for testing materials as revised to date by said Society.

Hard Plaster. To be an approved straight gypsum plaster.

Metal Corner Beads. To be a bead not less than 24 gauge galvanized.

Lathing. All wood lath to be nailed to each stud joist or bearing with joints broken not over seven lath to a break, no diagonal nor vertical lathing allowed, a full 3/8" key to be left for lime mortar and not less than a full 1/4" for hard plaster.

Lime Mortar. To be composed of clean coarse sand, fresh lump lime and hair and fibre in proper proportions and to be well slaked and protected.

Putty. Lime putty to be run off in a tight putty box, thoroughly tempered and screened through a fine putty screen.

Hard Finish. To be composed of cold run lime putty, fresh plaster of paris and sand to be well troweled to a smooth even surface, free from blisters, checks and other imperfections.

Sand Finish. All float sand finish to be composed of lime putty and sand to be

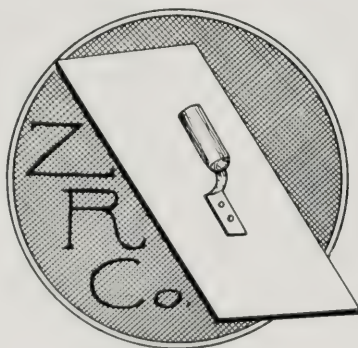
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water floated with a float to an even granular or sand surface.

Scratch Coat. All scratch coating to be well laid on and surface covered with a full coat which is to be scratched with wire scratcher to be well under cut for the brown coat, all lime mortar scratch coating to be dry before applying the brown coat.

Brown Coat. All brown coating to be well applied, allowing only sufficient space for the finish coat, brown coat to be rodged and screeded with all angles straight and true, all hard plaster to be mixed in accordance with the directions of the manufacturer and no hard mortar to be floated with water nor shall any "dead" material be retempered or used.

Wire or Metal Lath. Shall be lapped at each joint or seam and shall be stapled every six inches with blued or galvanized staples.

Band Iron Furring. The following shall be furred with $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ " or 1" corrugated band iron furring, such furring to be stapled to bearings and the wire or metal lath to be stapled over such band iron furring.

Suspended Ceilings. To be constructed with $1\frac{1}{2}$ " or 2" flat bars, angles or channels as may be called for, such principals shall be spaced 4' 0" on centers, hung with flat bar or not less $\frac{1}{4}$ " rod hangers every 4' 0" securely fastened with approved clips to the structural framing or through the floor construction, in the event these hangers go through the floor construction they shall be provided with 6" channels or flat bar anchors, no hanger shall be supported from the bottom flange of the tile arch. The flat bar, angle or channel runners shall be cross furred 12" on centers with $\frac{3}{4}$ " steel channels, securely secured to the principals with rod clips, entire construction to be lathed with No. 18 W. M. gauge $\frac{3}{8}$ " mesh painted wire lath or No. 24 U. S. Gov. standard gauge metal lath, lath to have lapped edges at each joining and to be tied to the channel furring every 6" with 18 gauge galvanized tie wire.

Furring. All false beam or cornice furring to be constructed of $\frac{3}{4}$ " channel or 1" flat bar brackets not over 2' 0" apart lined out with intermediate furring supports and anchored or toggle bolted into the construction to be made to conform to the design so as to allow for a minimum of plaster, such brackets to be covered with 18 gauge wire or 24 U. S. Gov. gauge metal painted lath secured with 18 gauge galvanized tie wire, such furring to conform to the latest and best practice as to durability of construction.

Cornice Work. All moulded beams and cornices will be screeded and run in place with moulds, with true lines and accurate mitres.

Ornamental Work. All ornamental work to be modeled by artistic modelers who will be approved by the architects. Models to be submitted for approval and no casts to be made until such models have been approved, all patterns to be gotten out by skilled mechanics with true and accurate lines.

Casts. All casts to be well made, the contractor to supply a sufficient number to meet the requirements of the job, all casts to be made in line, well and truly undercut and free from warps and other irregularities supplying all necessary shrinkers and stretchers.

Rough Casting. Lath the exterior of the house with 18 gauge wire or 24 U. S. Gov. metal painted lath stapled over 1" band iron furring scratch coat with mortar composed of 2 vols. of coarse, sharp sand 1 vol. of approved Portland cement, to which mixture add 15% of rich lime mortar, thoroughly scratched and undercut when this coat was "set," brown with mortar composed of 3 vols. sharp sand to 1 vol. Portland cement rod and straighten all surfaces and when this coat has "set" rough cast with mortar composed of 3 vols. of sharp sand or pebbles to

2 vols. Portland cement dashed on surface with a scoop or paddle to an even artistic finish.

Exterior Plastering on Wood Lath. Lath the exterior with No. 1 soft pine one-inch lath, nailed to each stud furring or bearing with not less than a 3 penny nail with full open $\frac{3}{4}$ " key space and not over seven lath to a break, plaster with 3 coats of cement plaster as called for under exterior plaster on metal lath, note the use of "hard plasters" so called are not recommended for exterior plastering.

Concrete Walls and Columns. All work on concrete walls and columns shall have such concrete well brushed with steel brushes and such concrete shall then be covered with a light coat of an approved bond cement as a bonding coat for the finish coat.

Concrete Ceilings. Shall first be washed with a solution of muriatic acid and such ceilings shall then be plastered as above.

Painted Walls. Walls that are to be coated with waterproofing shall first be scratch coated, then browned and finished.

Patching of Plaster. All patching of plaster damaged by other mechanics shall be paid for at the uniform scale of prices adopted by the Employing Plasterers' Association of Chicago, which scale of prices is set forth in the Hand Book.

Workmen's Compensation. This contractor shall insure his workmen under the provisions of the Workmen's Compensation Laws of the State of Illinois. This contractor shall also insure his liability for injury or death to "the public."

Scaffold. This contractor shall supply all necessary tools, scaffold and other appliances necessary to fulfill the requirements of the job, all scaffolding to be erected and maintained in accordance with the laws of the State relating to scaffolds.

Requirements. By Building Code in buildings of ordinary construction. At least three coats of plaster on all wood lath to 1 inch grounds.

By Union. All plain and ornamental plaster to the same contractor, the base coat of Portland cement under encaustic tile, cement base when installed independent of the floor or if more than 6" in height. All plastering regardless of the nature of the structure or of the material used.

RECOMMENDATIONS.

The use of soft pine lath, specify No. 1 white pine lath nailed to each stud, joist or bearing with 3 d. fine 16 gauge wire nails, with joints broken at least once in each seventh course or lath.

For better residence work specify one inch lath as above.

Wire or metal lath, specify No. 18 Washburn and Moen gauge wire lath $\frac{3}{8}$ " mesh, painted, or No. 24 U. S. Gov. standard metal lath painted, for better class work specify wire lath woven from galvanized strand or metal lath galvanized.

The use of wire or metal lath plastered insures slow burning construction, helps to prevent settlement cracks and bonds and ties all parts of the structure together, its use is called for in almost every building, particularly on basement ceilings to prevent or retard fire on ceilings with long span joist construction on store ceilings and under other space subject to heavy use or abuse. Its use should also be general in all better class building, in rated buildings its use throughout entitles it to better classification for insurance.

The Association recommends the use of three coat plastering. This will insure a far better class of work, a better bonding together of buildings of ordinary construction, due to the use of a greater body of material. The application of the second base coat enabling one to straighten out rod and line work. Specify three-coat dry work, first coat to be a scratch coat well scratched and un-

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der cut. When dry, apply a brown coat, this brown coat to be screened and rodded and when dry apply a finish coat.

The following suggestions are offered for guidance:

Sand. The use of clean, coarse, sharp sand is essential for good plastering.

Metal Lath. Should be laid with lapped edges or joinings and should be stapled to bearings every 6". No suspended ceilings should be supported from the bottom or soffit of tile.

Portland cement base coat behind encaustic tile, Opalite or kindred material should be specified under "Plastering" with one rodded coat scratched on tile or brick or a scratch and rodded brown coat scratched on metal or wire lath. We do not recommend Portland cement direct to gypsum partition or gypsum furrings.

Damp proofed, waterproofed or painted walls and ceilings are required to be given 3 coats. If a finish coat is desired, it should be so specified. All lathing plain and ornamental plastering should be specified under one heading in order to avoid divided responsibility for final results.

JURISDICTION CLAIMS.

By Plasterers' Union, any and all plastering regardless of the nature of the material, or of the structure to which it is applied, including Scagliola made under the "New Process" so called.

By Lathers' Union, all lathing, metal corner beads and all light iron furring designed, specified or used primarily as a support for lath and plaster, including "Hi Rib."

By Hodcarriers and Building Laborers' Union, all scaffolding erected for the use of plasterers.

PATCHING OF PLASTERING AFTER OTHER TRADES.

Patching of plastering after other mechanics shall not be done as a part of the contract price, and shall be paid for at the following scale of prices which have been adopted by and are recommended by the Employing Plasterers' Association of Chicago.

In accordance with wage agreements effective, and present prices of materials, the following scale of prices for patching of plastering after other mechanics and for work done upon a time and material basis, is respectfully submitted.

The prices herein include cost of insurance of men under the provisions of the Workmen's Compensation Laws of the State of Illinois.

Foreman Plaster	\$2.60	per hour
Plasterers	2.35	per hour
Foreman Lather	2.60	per hour
Lathers	2.35	per hour
Plasterer Laborer	1.50	per hour
Mortar	3.50	per bbl.
Putty	4.00	per bbl.
Hydrated Lime .....	.80	per bag
Neat Hard Plaster	1.40	per bag
Stucco	1.40	per bag
Metal or Wire Lath .....	.45	per yard
1½" Pine Lath .....	.90	per bunch

Owing to abnormal conditions material prices are subject to change without notice, and labor scale will be proportionately increased where bonuses are required to be paid in order to get men.

18 gauge ¾" mesh painted wire lath or 24 gauge expanded metal painted45	per yard
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Where seven or more men are employed in one gang on same kind of work, foreman's time will be charged continuous while work is going on, where less than seven men are employed in one gang on same kind of work, foreman's time shall be counted one hour for each seven hours of men aggregate time employed on this work, unless foreman's time is required constantly, when he shall be so paid.

CITY ORDINANCE.

Be it ordained by the City Council of the City of Chicago:

Section 1. That Section 605 of the Chicago Code of 1911 be and the same is hereby amended so as to read as follows:

605. **Wood Lathing and Plastering.)** (a) In all buildings of ordinary construction, where the use of wood lath and plaster is permitted under the provisions of this chapter, such wood lath and plaster shall be done in accordance with these specifications:

Wood lath shall not be over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than one-fourth of an inch apart. All wood lath must be covered with at least three coats of plaster; such lath and plaster to finish to a total thickness of at least seven-eighths of an inch; no dirty or loamy sand to be used in the mortar or plaster.

(b) In every building of ordinary construction which contains one or more rooms used for habitation or living purposes, the walls and ceilings of all rooms, including stores (except basement and attic rooms not used for habitation or living purposes), throughout the building shall be covered with not less than three coats of plaster of the thickness and quality hereinbefore in this section prescribed.

Provided, however, that where such building does not exceed one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in the room used for the purpose of Class I; and provided further, that where such building of ordinary construction and containing one or more living rooms is more than one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in such room used for the purpose of Class I according to the following provisions:

The ceiling of the room or rooms used for the purpose of Class I shall first be plastered with at least two coats of plaster on wood lath; wood lath to be not over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than three-eighths of an inch apart. All wood lath to be covered with a heavy coat of mortar; such lath and plaster to finish to a total thickness of three-quarters of an inch in thickness. Before applying such metal ceilings, a wood strip not less than seven-eighths of an inch by one and one-quarter inch wide shall be used under every lap bead, or nailing flange at the intersection of all plates. Strips to be not more than two feet on centers in the direction of length of rooms with a cross strip every four feet on centers. A wire nail not less than three inches long shall be used in every strip at every joist in the surface to be covered. Metal plates to be not lighter than 29 gauge in thickness and nailed to every six inches on the lap.

(c) Where said metal plates are applied on walls of buildings of ordinary construction containing one or more rooms used for habitation or living purposes, plastering upon walls must conform with the requirements of this ordinance for plastered walls. A strip three-eighths of an inch in thickness may be used upon which to apply the metal, same to be nailed to every studding with a nail not less than two and three-quarter inches long; steel plates used on walls to be not lighter than 29 gauge and applied same manner as herein provided for ceilings.

Section 2. This ordinance shall be in force and effect from and after its passage and due publication.



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RULES OF MEASUREMENT FOR MASON WORK

As adopted by the Builders Association of Chicago and the Associated Builders of Chicago.

Introduction.

The following rules are the expression of a custom founded in equit yand prevailing in this city from its earliest days.

If to furnish and lay one thousand brick in a plain dead wall cost ten dollars, another piece of brick work of equal cost must be measured as of the same contents, even though it does not take one-fourth as many brick.

The plain dead wall, in stone as well as brick work, is taken as the standard, and more difficult, complicated ornamental and hazardous kinds of work are measured up to it, so as to make the compensation equal. To illustrate: If in one day a man can lay two thousand brick in a plain dead wall, and can lay only five hundred in a pier or arch in the same time, the cost of labor per thousand in such work is four times as much as in a wall, and is entitled to extra compensation; but instead of varying the price, the custom varies the measurement to compensate for the difference and thus endeavors to secure a uniform price per thousand for all descriptions of ordinary brickwork, instead of a different price for the execution of the various kinds of work.

This is the principle underlying the system.

If any new rules or new applications of old rules should be found in the following, we can only say in their recommendation that we have carefully considered them in all their bearings, endeavoring to secure equal justice to owner as well as contractor, and that they will form the standard for deductions as well as for compensation for extra work.

The units of measurement of masons work are:

- For Excavation, the cubic yard.
- For Concrete, foundations, the cubic foot.
- For Concrete, floors, the superficial foot.
- For Dimension stone, footings, the superficial yard.

- For Dimension stone, bridge masonry, the cubic foot.

- For Dimension stone, surface dressing, the superficial foot extra.

- For Rubblework, the cubic foot.

- For Rubblework, surface dressing, the superficial foot extra.

- For Brickwork, common, the thousand brick.

- For Brickwork, pressed, the superficial foot.

- For Tuckpointing, cleaning fronts, the superficial foot.

- For Plastering, plain surfaces, the superficial yard.

- For Plastering, cornices, the running and superficial foot.

Excavation.

To be measured and computed by the actual amount of material displaced—no allowance for rehandling.

Concrete. Floors—Foundations.

Measure actual contents.

Floors to be measured by the superficial foot of surface between walls.

No deductions for tile drains, nor for any pier, chimney breast, plaster or other projections of walls of ten feet or less in area.

Where concrete takes the place of stone or brickwork, figure the contents the same as you would brick or stonework.

It is not safe to do concrete work at less than 30 degrees above zero.

Dimension Stone—Footings.

Footings to be measured each course separately—no deduction for drain or other

openings under walls two feet or less in width.

Bridge Masonry.

Compute actual cubic contents.

Surface dressing of all kinds, extra.

It is not safe to do Dimension stone work at less than 25 degrees above zero.

Rubblework.

Footings to be measured by actual contents.

Note.—Footings are all such foundation courses, not exceeding sixteen inches in height each, as are wider than the body of the above.

Note.—In the following the term Corner is used for salient angles of walls, and Angle for re-entering angles.

It is not safe to do rubblework at less than 25 degrees above zero.

External Walls.

Girt building and add thickness of wall for each external angle.

Partition Walls.

Intersection of partition walls two feet or less in width to be measured double; if wider, add four cubic feet to actual contents of every intersection for each foot in length.

Beveled Corners.

For each corner of wall more or less than ninety degrees, add one foot six inches to length of wall.

Circular Walls.

For round walls add one-fifth of length of girt measure.

Pilasters, Etc.

All projections, such as chimney breast, piers connected with walls, and pilasters to be measured actual cubic contents contained therein, and one cubic foot added thereto for each corner for every foot in height.

Piers.

Independent square piers to be measured by the same rule.

Polygon and round pier work at special rates.

Recesses, Etc.

Recesses and slots to be measured solid, and in addition thereto allow one cubic foot for every foot in height.

Arches.

Stone arches are classed as cut-stone work.

Openings.

Deduct contents of windows, doors and other openings, measuring from top of sill to spring of arch, and add two feet of wall for each jamb for every foot in height of opening.

No deductions are to be made for cut-stone trimmings and lintels.

Brickwork.

Note.—Different cities make different brick; in reality the products of no two brickyards are entirely alike in size, nor, for that matter, all bricks burned in the same kiln. The necessity of acknowledging some standard for purpose of measurement and calculation is obvious. In these rules the dimensions of a brick are understood to be 2 by 4 by 8 inches. We therefore speak of 4-inch walls, meaning the width of one brick; of 8-inch, meaning the width of two-bricks, and 12-inch walls, meaning the length of one and width of another brick, etc., although the actual width of wall will be more or less in excess of these measures.

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Every superficial foot of "one-half brick (or 4-inch) wall" to be estimated at seven and one-half bricks; of "one brick (or 8-inch) wall" at fifteen bricks; of "one-half brick (or 12-inch) wall" at twenty-two and one-half bricks; of "two brick (or 16-inch) wall" at thirty bricks, etc.—increase the number of brick by seven and one-half for every additional half-brick in thickness of wall.

It is not safe to lay brick at less than 20 degrees above zero; brick laid in cement at less than 25 degrees above zero.

External Walls.

If sixteen inches thick or less girt building and add thickness of wall for each external angle.

When thicker, add to actual contents of each corner one and one-half cubic feet for every foot in height.

Allow for wall ends as for corners.

Round Walls.

Sixteen inches thick or less.

For circular walls, or radius sufficiently large to obviate the necessity of using specially molded or cut brick, add one-fifth of length to girt.

When thicker allow for sixteen inches of such wall as per above rule, and measure all in excess as straight work.

Cut or molded at special rates.

Beveled Corners.

For each corner of wall of more or less than ninety degrees, add one foot six inches to length of girt.

Partition Walls.

Sixteen inches thick or less. Intersection of partition walls (bonded together in any manner—not abutting) to be measured double.

When thicker, add one and one-half cubic feet to actual contents of every intersection for each foot in height.

Partition walls connecting with stone walls to be measured one foot into such wall.

Chimney Breasts and Pilasters.

All flues and hollows in chimneys four feet or less in area to be measured solid.

When larger deduct one-half contents of flue.

For all chimney breasts and pilasters add eight inches to face for each corner and multiply length so obtained by width (projection).

Detached chimneys in buildings and plain chimney tops to be measured solid and one-half of one cubic foot to be added for each corner of every foot in height.

Stacks.

Chimney stacks at special rates. When square, find cubic contents, measuring hollow walls solid, and deducting flue. When round or octagon, take length of diameter for side, and measure as though it was square.

Piers.

Independent piers to be measured like chimneys.

Hollow Walls.

Hollow walls to be measured solid.

Stone Fronts.

Stone fronts backed with brickwork, deduct thickness of ashlar from width and figure ordinary walls.

Gables and Wall Tops.

Whenever clipping of brick is required, add to actual contents the length of line of clipping by one foot by thickness of wall.

Cornices and Belts.

If of running courses only, multiply length by height (greatest grit in the cut) by greatest projection.

If enriched (by corbels, brackets and panels), multiply other dimensions, as given, by greatest grit length.

Ledges.

Multiply length by height by greatest projection.

Projections.

All other projections, if four inches or less, to be measured four inches; if above four inches, and not exceeding eight inches, to be measured eight inches; if above eight inches, and not exceeding twelve inches, to be measured twelve inches, etc.

Gauge Work.

Gauge work at special rates.

Openings.

Openings to be measured from top of sill to spring of arch and shortest distance between brick jambs for width.

No deductions to be made for openings two feet six inches or less in width.

One-half of contents to be deducted of openings from two feet six inches to six feet in width.

For openings of more than six feet in width allow one foot six inches by thickness of wall by height for each jamb.

Slots, Panels, Etc.

No deduction to be made for slots, chases, niches, panels or other recesses of four feet or less in width; if wider deduct contents and add two cubic feet of wall for every foot in height.

Trimmings.

No deductions in measuring brickwork for cut-stone or other trimmings, bond-blocks, timber, joists or lintels.

Arches.

Arches—not gauged.

In vaults, multiply length of chord at spring of arch by height from chord to extrados by thickness of arch.

In walls: find contents of arch by same rule and add to wall measurement.

In sewer and tunnel arches multiply length of extrados by thickness of arch.

Floor Arches and Brick Paving.

Floor arches and brick paving to be measured by the superficial foot and by rule given for measuring concrete. Deduct well-holes.

Brick-Nogging.

Measure as ordinary brickwork. Deduct full openings—no studding.

Cutting.

Cutting of joists or other holes by the piece; of slots, panels and recesses by the lineal foot.

Toothing.

When ordered by the owner or his superintendent to tooth, rack or block, in consequences of delay, of iron, stone or other material, that masonwork may connect with, such toothing, racking or blocking shall be measured as extra work, as follows: Increase girt length of such line by one-half, and multiply by one foot of thickness of wall.

Pressed Brickwork.

Measure all exposed surfaces of brick by the superficial foot.

Cut-Stone Setting.

Measure vault covers, flagging, curbing and ashlar by the superficial foot, coping and belt courses by the lineal foot; all other cut stone by the cubic foot.

Tuckpointing and Cleaning.

Tuckpointing and cleaning and pointing stonework to be measured by the superficial foot of exposed surfaces.

Deadening.

Deadening to be measured by the superficial yard, floor measure, between walls—take out well holes.

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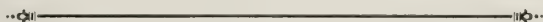
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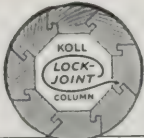
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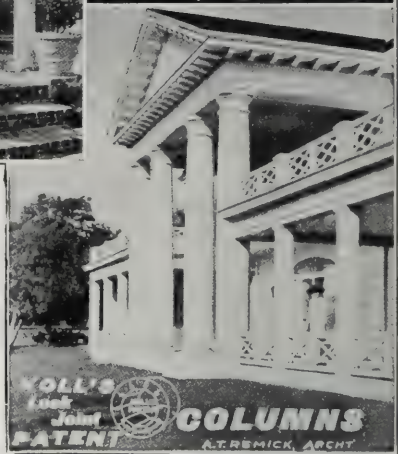
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MISCELLANEOUS AND USEFUL INFORMATION CONCERNING BUILDING ENGINEERING, TRADES AND MATERIALS.

The following pages contain tables, formulae, and miscellaneous information intended to be of assistance to architects in the preparation of plans, specifications, estimates, and the general supervision of the construction work. In order to make the classification simple and to follow a uniform system this matter is classified according to the Dewey System, see page 751, and the file or classification numbers are printed in small type at the head of each piece of matter falling under a different classification. As far as possible the names of authorities quoted are given but in some cases this has been impossible.

RULES AND FORMULAS FOR THE DESIGN OF SIMPLE WOOD BEAMS OR JOISTS

When a beam is to be designed its length and the loads to which it is to be subjected are known, thus the maximum bending moment may be found.

The allowable-working-strength is assumed in accordance with engineering practice and must not be more than allowed by building laws, locally applicable. This allowable-working-strength is usually stated in municipal codes as a fixed number of pounds per square inch of cross sectional area, for each kind of material. This might just as well be stated in tons or any other unit of weight per square foot or any other unit of area, it being only important that whatever unit of dimension is used that the same unit shall be used both for areas, lengths and breadths.

Breadth-of-the-beam times the-square-of-the-depth divided by six equals Bending Moment divided by allowable-working-strength per unit of area corresponding with unit of length used for stating the length and breadth of beam.

Bending-Moment (for beams uniformly loaded) equals weight-to-be-supported-per-unit-of-length times the-square-of-the-total-number-of-units-of-length divided by eight.

For a simple beam loaded with a single weight, the maximum-Bending-Moment (which is to be used in formula) equals the-entire-load times [(the-length-of-the-beam) minus (the-distance-of-the-load-from-the-left-hand-end)] times the-distance-of-the-load from-the-left-hand-end-of-the-beam divided by the-length-of-the-beam.

If the load be movable the-distance-of-load-from-left-hand-end will be variable and the maximum-moment will be developed when the load is at the middle where the maximum-Bending-Moment is equal to one-fourth-the-load times the-length-of-the-beam. Placing the entire load on a beam at its center therefore produces the maximum strain that it is possible to produce on such beam by any position of such load.

APPLICATION OF ABOVE PRINCIPLES.

M=maximum bending moment.

S=the tensile or compressive unit stress per square inch allowable by building code or engineering practice for the material selected (See Section 539, Chicago Municipal Code, using the smallest value where there is a difference between compression and tension strength.)

l=length in inches of beam between supports.

b= breadth in inches of the beam.

d=depth in inches of the beam.

w=weight in pounds on beam including the weight of the beam itself per each inch of length.

W=total weight in pounds on beam=l w.

FOR UNIFORM LOADING.

$$b = \frac{3 w l^2}{4 d^2 S} = \frac{3 W l}{4 d^2 S} = \text{breadth of beam.}$$

$$d = \sqrt{\frac{3 w l^2}{4 b S}} = \sqrt{\frac{3 W l}{4 b S}} = \text{depth of beam}$$

To find b it is necessary to assume a value for d. Also to find d it is necessary to assume a value for b. In case it is found that the value by formula is too large or too small for practical use, then assumed value must be changed so as to bring the computed value to a practical size.

DESIGN OF REINFORCED CONCRETE COLUMNS UNDER THE NEW BUILDING CODE OF THE CITY OF CHICAGO

H. G. Overholt, C. E., Member Am. Soc. C. E.

Preliminary

This discussion and treatment of the design of reinforced concrete columns is based on the latest available draft of the proposed revision of the code. The article and section numbers used in that draft and in this article are the same as appear in the Joint Code of the American Concrete Institute of 1928; also all symbols and notation are the same. Only one departure from the Joint Code has been made in the new City Code; this relating to the effective section of Columns with Lateral Ties.

Five grades or qualities of concrete will be recognized for columns. These grades have ultimate crushing strength values, (f_c'), of 2000, 2500, 3000, 4000 and 5000 lbs. per sq. in. with respective values for n of 15, 12, 10, $7\frac{1}{2}$ and 6. The text of the discussion following is simplified by omitting references to the various classes of concrete.

Concentrically Loaded Columns

"Columns" are limited in length to eleven times the least lateral dimension, but "Long Columns" having greater length ratios are permitted under a special load-reduction formula (Sec. 1108) as explained below under that heading.

Section 1102 defines the unsupported length of columns for all cases and types of construction.

Columns are of two types viz: Tied Columns and Spiral Columns. The fireproofing or protective covering for Tied Columns is to be not less than 2" nor more than 3" clear from face to vertical steel but the effective section (A_g) of Tied Columns may be taken to within one inch of the faces, i.e., the core size is 2" less than size of column. For spiral columns, one and one-half inches of covering is required clear outside of the spiral. The effective core diameter may be taken to the outside diameter of the spiral, which is 3 inches less than the diameter of the concrete section.

Formula for Design of Tied Columns (Sec. 1104):

The design formula is

$$P = 0.225 f_c' A_g [1 + (n - 1) p]$$

p is to be not less than $\frac{1}{2}\%$ nor more than 2%.

A_g is measured to within one inch of the faces of the member.

When bending stresses are computed $0.3 f_c'$ may be used in the formula and ratios of p up to 4% are allowed.

Spiral Columns

In the design of spirally reinforced columns, there are two radical differences between the new code and the old City Code. One new feature is that the spiral, or percentage of spiral, does not come into the design formula. The other new feature is the introduction of a sliding scale for the allowable unit stress on the concrete, according to the percentage of vertical steel, as expressed in the formula:

$$f_c = [300 + (0.10 + 4p) f_c'] \quad (22a) \text{ of Sec. 1103}$$

This value of f_c is used in the actual design formula:

$$P = A_c [1 + (n - 1) p] f_c \quad (22) \text{ of Sec. 1103}$$

The only variable open to the option of the designer is the percentage of vertical steel. This fact permits the preparation of a simple table giving the average total permissible stress per sq. in. on the area of the core for all classes of concrete and percentages of vertical steel. Table 1 gives these values, also the corresponding value of f_c as from formula 22a. The spiral reinforcement is required to be not less than one-fourth of the percentage of vertical reinforcement. Spacing requirements and other details are given in Section 1103.

Eccentrically Loaded Columns or Columns Carrying a Bending Moment as Well as Direct Stress.

Provisions of the Code: The code permits an increased value of f_c when the stress due to bending or eccentric load is taken into account. This increase is $0.15 f_c'$ in all spiral columns. See Section 1105c. The determination of bending moments is treated in Section 1105. The new codes of Chicago, New York and numerous other cities make it mandatory to determine the bending moments in columns on the principle of rigid frame analysis. This analysis has appeared to be of prohibitive difficulty to many designers in the past, but simplified methods and procedure have now been developed which shorten the necessary work sufficiently to bring it within design cost limits on ordinary commercial work. An excellent and illuminating introduction to this subject is presented in the article by Prof. G. A. Maney which follows this discussion on columns.

After the bending moments on the columns have been determined the following formulas and procedure may be followed for the design of the columns. The fundamental formula of mechanics for bending and direct stress, when supplied with the symbols for a reinforced concrete column, becomes

$$f_c = N \left(\frac{1}{A_t} + \frac{e r}{I_t} \right) \quad (a)$$

$$f_c'' = N \left(\frac{1}{A_t} - \frac{e r}{I_t} \right) \quad (b)$$

where

$$A_t = \pi r^2 [1 + (n - 1) p]$$

$$I_t = \frac{\pi d^4}{64} [1 + 2(n - 1) p]$$

f_c and f_c'' are unit stresses in the concrete on the two faces of the column.

N = direct load on the column.

r = radius of the column core.

e = eccentricity.

= bending moment divided by the direct load N .

A_t and I_t are the area and moment of inertia of the transformed section. By substitution

$$f_c = \frac{N}{\pi r^2} \left[\frac{1}{1 + (n - 1) p} + \frac{e}{r} \frac{1}{0.25 + 0.50(n - 1) p} \right]$$

$$f_c'' \text{ becomes zero when } \frac{e}{r} = \frac{1}{4} \left[\frac{1 + 2(n - 1) p}{1 + (n - 1) p} \right]$$

$$f_c \text{ (due to bending only)} = 0.15 f_c' \text{ when}$$

$$\frac{M}{d^3} = 0.15 f_c' \frac{\pi}{32} [1 + 2(n - 1) p]$$

NOTE:—The above basic formulas are based on the assumption that the vertical steel is located on the periphery of the column core, as first proposed by Mr. Chas. S. Whitney of Milwaukee. The steel is then considered as a thin shell, having n times the strength of concrete, and the ordinary principles of mechanics are applied. Since the vertical steel is about $\frac{3}{4}$ " inside the core limits on spiral columns there will be an error introduced which is away from the safe side and which is considerable in the case of smaller columns and higher percentages of reinforcement. To correct for this condition, the values for I and S and R in the tables have been reduced by ten, ten and five percent respectively, which keeps them on an equivalent basis.

A small supplementary table gives the corrections in percents that should still be applied to the tabular values for I and S to get true results for a column with the bar circle one and one-half inches less in diameter than the core diameter. Where plus signs appear, the error in the tables is on the safe side. The correction for values of R is one-half of the amount of correction given for values of I in Table 4.

For square sections, computations for bending stress should be based on the core size taken only to center of vertical bars. The values in the table are correct for this case.

Procedure in Design:

The first step in designing a column carrying bending is to determine whether the stress due to bending falls within the additional unit stress

allowance of $0.15 f_c'$ permitted by the code. If so, no change is needed from the section required for direct load only. Diagram I may be used to answer this question. Compute the value of $\frac{M}{d^3}$ for the trial column section (as required for direct load only). If the intersection point for $\frac{M}{d^3}$ and p falls below the concrete line, the bending stress is less than $0.15 f_c'$.

If the intersection point is above the line, a heavier section must be assumed and the value of f_c computed by formula (a), using the tables for value of I_t .

Where the bending moment is so large in proportion to the direct load as to cause tension on one side of the column, the formulas (a) and (b) are invalid and must be replaced by much more cumbersome ones. In order to determine readily whether tension occurs, the diagram II has been developed. If the intersection of the lines representing $\frac{e}{r}$ and p falls below the concrete line, the entire column is in compression and formula (a) is valid.

From this diagram it will be seen that for eccentricities approaching one-third the radius or one-sixth of the diameter of the column, tension develops in the column. As long as this tension is small it is carried by the concrete and formula (a), and formula (b), continue to apply.

The writer considers it perfectly safe to allow values of $\frac{e}{r}$ up to 20% above the points on the curves, corresponding to tension in the concrete of less than $0.10 f_c'$ in computing the maximum stress f_c by formula (a).

For computed values of f_c'' exceeding $-0.10 f_c'$ other formulas must be used. This is generally referred to as Case II in the reference books on the subject which should be consulted. The treatment is considered too long for inclusion in this discussion.

It should be kept in mind that both Diagrams I and II are based on column sections which are fully stressed by the direct load. Where this is not the case, formulas (a), and (b) should be applied to compute correct values of f_c and f_c'' .

Long Columns:

Formulas for the design of "long columns" (columns longer than eleven diameters) are given in Section 1108. If the designer will realize that practical limitations of slenderness will hold the reduced strength to a value within 5% to 10% of that for ordinary columns, the selection of a first trial section will be less baffling. Begin with a trial section having about 5% excess strength, select R from the Table 3 and compute $\frac{P}{P'}$. If less than 0.95, a second trial must be made. For exceptionally slender columns begin with a trial section having 10% of excess strength.

Table 1

PERMISSIBLE AVERAGE STRESS ON CORE AREA OF SPIRAL COLUMNS

Total load on column divided by values in this table gives the required core area.

p in %	Values of the Term $[1 + (n - 1) p] f_c$				
	2000 lb.	2500 lb.	3000 lb.	4000 lb.	5000 lb.
1.0	661	721	785	916	1050
1.5	750	815	885	1027	1182
2.0	845	915	991	1152	1320
2.5	945	1020	1102	1279	1462
3.0	1050	1130	1219	1410	1610
3.5	1162	1246	1341	1546	1762
4.0	1280	1368	1469	1688	1920
4.5	1402	1495	1602	1835	2082
5.0	1530	1628	1740	1987	2250
5.5	1681	1765	1883	2144	2422
6.0	1840	1910	2034	2308	2600

Table 2

Values of f_c used in Table 1.

p in %	Values of f_c in $f_c = [300 + (0.10 + 4p) f'_c]$				
	2000 lb.	2500 lb.	3000 lb.	4000 lb.	5000 lb.
1.0	580	650	720	860	1000
1.5	620	700	780	940	1100
2.0	660	750	840	1020	1200
2.5	700	800	900	1100	1300
3.0	740	850	960	1180	1400
3.5	780	900	1020	1260	1500
4.0	820	950	1080	1340	1600
4.5	860	1000	1140	1420	1700
5.0	900	1050	1200	1500	1800
5.5	940	1100	1260	1580	1900
6.0	980	1150	1320	1660	2000

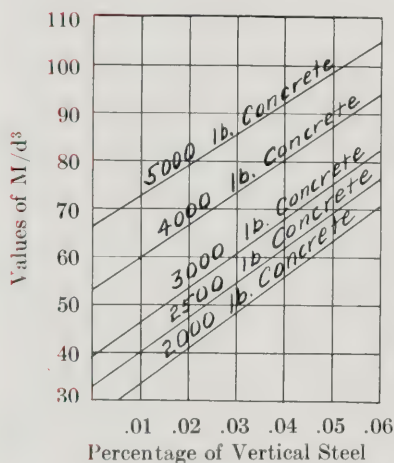


Figure I

Notes on Fig. I

If the intersection point for M/d^3 and P falls below the curve, the stress, due to bending is less than .15 f'_c and no change is needed from the column section required for direct load only. These curves give results on the safe side where plus signs appear in Table 4. For small columns or columns highly reinforced, use the value for S in Table 3, corrected as per Table 4 and apply the formula $f_c = M/S$.

Notes on Figure II

If the intersection point falls above the curve, tension occurs on one side of the column and the simple formulas of Case I do not apply. The writer considers it safe to allow values of e/r up to 20% above these curve points. See text.

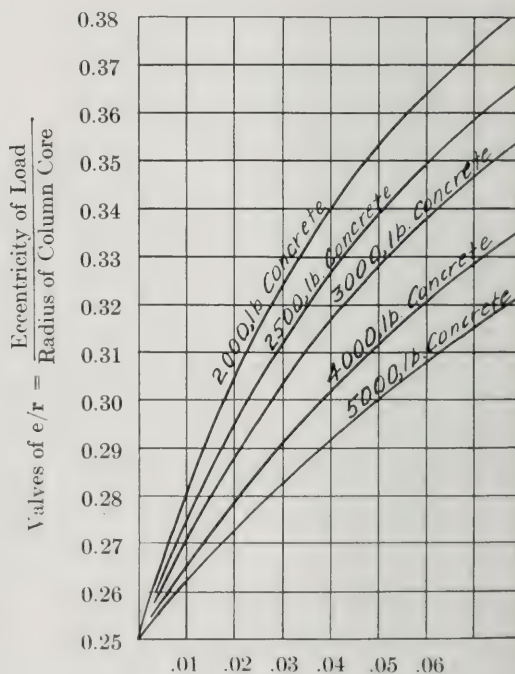


Figure II

Table 3

PROPERTIES OF REINFORCED CONCRETE COLUMN SECTIONS

NOTE:—Values for Spiral Columns in Table 3 are average values for ordinary column diameters. They are on the side of safety where plus signs appear in Table 4. For the larger negative values apply correction as noted below.

$I = Cd^4 =$ Moment of Inertia

$S = Kd^3 =$ Section Modulus

$R = Md =$ Radius of Gyration

% of Vertical Steel p	Constants	Spiral Columns					Square Tied Columns				
		Class of Concrete (f_c')					Class of Concrete (f_c')				
		2000	2500	3000	4000	5000	2000	2500	3000	4000	5000
0.5	C	0.0504	0.0490	0.0482	0.0471	0.0464	0.0950	0.0925	0.0909	0.0888	0.0875
	K	0.1008	0.0981	0.0964	0.0941	0.0928	0.1900	0.1850	0.1817	0.1775	0.1750
	M	0.245	0.244	0.243	0.241	0.240	0.298	0.296	0.295	0.294	0.293
1.0	C	0.0566	0.0539	0.0521	0.0500	0.0486	0.1067	0.1017	0.0983	0.0942	0.0917
	K	0.1132	0.1078	0.1042	0.0999	0.0972	0.2133	0.2033	0.1967	0.1883	0.1833
	M	0.252	0.249	0.247	0.245	0.243	0.306	0.303	0.301	0.298	0.296
1.5	C	0.0627	0.0588	0.0561	0.0528	0.0508	0.1183	0.1108	0.1058	0.0996	0.0958
	K	0.1254	0.1177	0.1122	0.1056	0.1016	0.2367	0.2217	0.2117	0.1992	0.1917
	M	0.257	0.254	0.251	0.248	0.246	0.313	0.308	0.305	0.302	0.299
2.0	C	0.0689	0.0637	0.0601	0.0556	0.0530	0.1300	0.1200	0.1133	0.1050	0.1000
	K	0.1379	0.1274	0.1202	0.1113	0.1060	0.2600	0.2400	0.2267	0.2100	0.2000
	M	0.262	0.258	0.255	0.251	0.248	0.318	0.314	0.310	0.305	0.302
2.5	C	0.0751	0.0685	0.0641	0.0586	0.0552	0.1417	0.1292	0.1208	0.1104	0.1042
	K	0.1503	0.1370	0.1281	0.1171	0.1104	0.2833	0.2583	0.2417	0.2208	0.2083
	M	0.267	0.262	0.258	0.253	0.251	0.324	0.319	0.314	0.308	0.305
3.0	C	0.0813	0.0734	0.0680	0.0614	0.0574	0.1533	0.1383	0.1283	0.1158	0.1083
	K	0.1627	0.1467	0.1361	0.1229	0.1148	0.3067	0.2767	0.2567	0.2317	0.2167
	M	0.270	0.265	0.261	0.256	0.252	0.328	0.323	0.318	0.311	0.308
3.5	C	0.0875	0.0783	0.0720	0.0643	0.0596	0.1650	0.1475	0.1358	0.1212	0.1125
	K	0.1750	0.1565	0.1440	0.1286	0.1193	0.3300	0.2950	0.2717	0.2425	0.2250
	M	0.274	0.268	0.264	0.259	0.254	0.333	0.327	0.322	0.314	0.310
4.0	C	0.0937	0.0831	0.0760	0.0671	0.0619	0.1767	0.1567	0.1433	0.1266	0.1166
	K	0.1874	0.1662	0.1520	0.1343	0.1238	0.3533	0.3133	0.2867	0.2533	0.2333
	M	0.277	0.271	0.267	0.261	0.256	0.336	0.330	0.325	0.317	0.312
4.5	C	0.0999	0.0880	0.0800	0.0700	0.0641	Values given for Square Tied Columns are to be used only where the effective core size is taken to the center of the vertical steel. The corrections in Table 4 do not apply to these values.				
	K	0.1998	0.1760	0.1600	0.1400	0.1282					
	M	0.280	0.274	0.270	0.263	0.258					
5.0	C	0.1061	0.0928	0.0840	0.0729	0.0663	* * * * *				
	K	0.2122	0.1856	0.1680	0.1458	0.1326					
	M	0.282	0.276	0.272	0.265	0.260					
5.5	C	0.1123	0.0977	0.0880	0.0758	0.0685	To get true values for I and S for Spiral Columns, reduce the figures in Table 3 where minus signs occur in Table 4 by the percentages indicated. Increase where plus signs appear. For R, use one-half of the indicated corrections.				
	K	0.2246	0.1954	0.1760	0.1516	0.1370					
	M	0.284	0.279	0.274	0.267	0.262					
6.0	C	0.1285	0.1026	0.0920	0.0837	0.0707					
	K	0.2370	0.2051	0.1840	0.1673	0.1414					
	M	0.286	0.281	0.276	0.269	0.263					

Table 4

Core Diameter	% of Vertical Steel p	2000 lb. Concrete	3000 lb. Concrete	4000 lb. Concrete	5000 lb. Concrete
10"	$p = .02$	- 8.0	- 3.0	+ 0.1	+ 2.2
	$p = .04$	-17.0	-11.2	- 7.0	- 4.0
	$p = .06$	-22.0	-16.5	-12.2	- 7.6
15"	$p = .02$	- 2.6	+ 1.0	+ 3.2	+ 4.8
	$p = .04$	- 9.0	- 5.0	- 2.0	+ 0.1
	$p = .06$	-12.9	- 8.8	- 5.7	- 3.4
20"	$p = .02$	+ 0.4	+ 3.2	+ 5.0	+ 6.1
	$p = .04$	- 4.6	- 1.3	+ 0.9	+ 2.7
	$p = .06$	- 7.6	- 4.3	- 1.9	+ 0.7
25"	$p = .02$	+ 2.3	+ 4.7	+ 6.1	+ 7.0
	$p = .04$	- 1.8	+ 0.9	+ 2.8	+ 4.1
	$p = .06$	- 4.1	- 1.6	+ 0.1	+ 2.4

RIGID FRAME ANALYSIS

by G. A. Maney, Professor of Structural Engineering, Northwestern University

In considering the question of moment-distribution in a rigid frame under vertical loading we are impressed by the importance of some working knowledge of this subject for the three following principal reasons.

1. Every reinforced-concrete frame or welded steel frame building presents this problem, and the riveted steel frame building can be so detailed as to provide rigidity of joints.

2. We have a considerable background of research and test data to prove that these types of frame joints are truly rigid for all the purposes of accurate engineering calculations.

3. The modern building codes as typified by the A.C.I. code are rapidly replacing the old codes with their $\frac{1}{10}$ and $\frac{1}{12}$ moment coefficients which were necessarily uneconomical, and these new codes allow and encourage the accurate calculation of moment distribution in rigid building frames under vertical load.

An easily applied method (and one that can be made as accurate as our knowledge of relative stiffness) is here presented. The engineer needs to have in mind the definition of two important factors as follows:

I. *Relative stiffness* or (more specifically) *relative* $(I \div L)$ values which are ratios of *Moment of Inertia* of beam or column cross section to *effective* length of span. There has been much controversy as to how to calculate "I" and "L" and in view of this we suggest the easiest of methods proposed. (a) Assume "I" to vary as bd^3 or as the product of width times depth cubed, (b) assume "L" to be clear span. Suffice it to say that we may properly assign to any beam or column an arbitrary value of (I) or unity and to any other member its *relative* $(I \div L)$ value. We call this $(I \div L)$ value "KA-B" for any member "A-B."

II. The fixed beam moment on all frame members loaded transversely (generally the beams only of building frame). By this we mean, of course, the bending moment (always causing tension in top fibers), which is developed at the end of a horizontal member (whose ends are fixed rigidly against rotation) because of downward or gravity loads. Let us call this moment M_{FA-B} at the end "A" of the member "A-B."

Our more common values of end moments in beams with fixed ends are as follows:

1. $\frac{WL}{12}$ for beam with total load uniformly distributed of "W."

2. $\frac{PL}{8}$ for beam with concentrated center load of "P."

3. $\frac{2PL}{9}$ for beam with load "P" at each of the $\frac{1}{3}$ points.

Many more special cases are given in handbooks and any special case can be worked out.

The object of our calculation is, of course, to determine the value and sense of the bending moments which around any joint must sum up to zero before that joint is in equilibrium. Having determined these end values it becomes a simple procedure to find all intermediate values of both Moment and Shear in any column or beam of the frame. In this discussion we will limit ourselves to the determination of these end values (which for columns are always the maximum ones, and for beams the maximum negative values) and we will work out our method by an application to an actual problem rather than by prolonged discussion. Since no solution of simultaneous equations is necessary and since a large frame presents no greater difficulties than a small one we will use for our illustration the small building frame three stories high and two bays deep, shown in the sketch of Fig. I.

The relative stiffness "K" was assumed to be unity for the two upper left hand columns. For other columns which were square and of equal clear length only relative d^4 values were needed, where "d" is the length of side of same.

For beams the ratio of $\frac{bd^3 \div L}{12^3 \div 10}$ became the *relative* "K" value. The effect of beam flanges on stiffness may be neglected. The loading (considered as all concentrated loading) is shown on the sketch as well as the "M_F" values in ft. lbs.

If the joint (A) were so stiffened by columns that a clockwise rotation ($+\Theta_A$) of joint was prevented as would practically be the case if "K_{AC}" and "K_{AE}" were 100 instead of 1, then the final bending moment in the beam at this joint (M_{AB}) would equal (M_{FAB}) or 75000#, and M_{AC} and M_{AE} would each have to carry 37500# of opposite rotational sense to (M_{AB}) to balance it. In the general case, however, the joint (A) would rotate clockwise and " Θ_A " would have a positive value, which would tend to relieve and reduce all three moments at this joint although they would still have to sum up to zero. (See Fig. II.) Similarly at joint (B) (see Fig. III) the net tendency to rotate is also a clockwise one because (M_{FBI}) with its clockwise tendency of 124,000# exceeds (M_{FBA}) with its counter-clockwise tendency to rotate the joint of 75000# by a 49000# clockwise difference. If the "K" values of the columns "BD" and "BF" were in excess of say 10 times as large as the "K" values of the beams at the same joint this difference of 49000# would split itself between columns "BD" and "BF" in proportion to their $(I \div L)$ values.

As shown, however, a clockwise value of " Θ_B " developing tends to increase "M_{BA}," decrease "M_{BI}" and cut down the 49000# difference considerably, thus reducing the column moments which must still develop this reduced difference.

It is seen that the joint rotation greatly relieves all bending moments around the joint "A." This is because the column rigidity is so much less than that of the beam framing in that it is closer to the simple beam condition than the fixed-ended condition. All the moments at joint "B", except M_{BA} are reduced slightly and the change from fixed-ended conditions is less since the column rigidity is greater than that of the beam at this joint.

If we desire greater accuracy it is only neces-

sary to obtain the values of " Θ " thruout on this simple assumption and repeat the operation using *first* approximations for the " Θ " values at *adjacent* joints and *second* approximations for the " Θ " value of the *joint in question* (about which we make our second set of moments sum up to zero).

As previously shown for joints "A" and "B" the other first approximations will be obtained for the remaining " Θ " values that affect joints "A" and "B".

$$\begin{aligned}\Theta_C &= \frac{+38000}{2(1 + 1.2)} = \frac{+38000}{4.4} = +8600 \\ \Theta_D &= \frac{+62500 - 38000}{2(1.2 + 0.9 + 3.1)} = \frac{+24500}{10.4} = +2360 \\ \Theta_E &= \frac{+74000}{2(4 + 3.1 + 1)} = \frac{+74000}{16.2} = +4570 \\ \Theta_F &= \frac{+123000 - 74000}{2(7.8 + 7.8 + 4 + 4.5)} = \frac{+49000}{48.2} = +1015 \\ \Theta_H &= \frac{-124000}{2(3.1 + 3.1 + 4.5)} = \frac{-124000}{21.4} = -5800\end{aligned}$$

The second approximation for the joints "A" and "B" are as follows:

$$\begin{aligned}\Theta_A &= \frac{+75000 - [(1)(+8600) + (4)(+1260) + (1)(+4570)]}{12} \\ \Theta_A &= \frac{+75000 - 18200}{12} = \frac{56800}{12} = +4730 \\ \Theta_B &= \frac{+49000 - [(4)(+6250) + (3.1)(+2360) + (7.8)(+1015) + (4.5)(-5800)]}{38.8} \\ \Theta_B &= \frac{+49000 - 14000}{38.8} = \frac{+35000}{38.8} = +900\end{aligned}$$

Now using these new values we have for joint "A" as follows:

$$\begin{aligned}M_{AB} &= +75000 - 8(4730) - 4(1260) = +32100' \\ M_{AE} &= -2(4730) - 4570 = -14030 \\ M_{AC} &= -2(4730) - 8600 = -18070\end{aligned} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \Sigma M = 0$$

Similarly for joint "B" we have:

$$\begin{aligned}M_{BA} &= -75000 - 8(900) - 4(6250) = -107200' \\ M_{BD} &= -6.2(900) - 3.1(2360) = -12900 \\ M_{BH} &= +124000 - 9(900) - 4.5(-5800) = +142000 \\ M_{BF} &= -15.6(900) - 7.8(1015) = -21900\end{aligned} \quad \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} \Sigma M = 0$$

The following tabular comparison of end moments in beams and columns after this second approximation as compared with correct values indicate these values to be within 5% of the final values which is close enough in view of the controversy as to span length and moment of inertia.

	M_{AB}	M_{AE}	M_{AC}	M_{BA}	M_{BD}	M_{BH}	M_{BF}
2nd Approx.	+32,100	-14,030	-18,070	-107,200	-12,900	+142,000	-21,900
Final Value	+30,600	-14,000	-16,700	-101,500	-12,200	+135,000	-21,100

If greater accuracy is desired one or two more approximations can be made.

This method of solution for the equations of the slope-deflection method has been in use since the writer stated the general method in 1915 and several similar solutions have been since proposed, principally the one by Professor Hardy Cross of Illinois. The reason for this convergence of " Θ " values is, of course, simple enough. Both an error in moment and an error in " Θ " value is reduced by the factor $\frac{1}{2}$ for joints once removed, by the factor $\frac{1}{4}$ for joints twice removed, by $\frac{1}{8}$ for joints three

times removed, etc. A study of the fundamental slope-deflection equations will bring this out. There is nothing particularly mathematical or difficult behind this convergence, being based on a simple physical relation, and has never been thought of by the writer except as a convenient method to use where the number of Slope-Deflection equations is large.

It will be noted that important bending moments are developed in the columns and provision for these moments has seldom been made in the past but as the new codes come in they undoubtedly will be.

ULTIMATE AND SAFE STRENGTH OF CONCRETE IN POUNDS PER SQUARE INCH.

[illegible]

These tables will cover variations of the material and give the range of strength that could be expected of good ordinary materials and workmanship. Inferior materials will come below the lowest limits given in these tables, and superior materials will come above the highest limits. The safe compressive unit stress to be used for long columns should be obtained from the use of some approved column formulae, which also should take care of possible eccentric applications of the load.

The safe extreme fiber stress for long, narrow beams and girders, including plate girders, not braced sideways, should also be obtained from some approved column formulae. In this manner the lateral strength of beams is

provided for.

The following method is believed to conform with good practice for computing loads in buildings:

Figure all parts of the building for the full dead load
Figure joists and beams for the full live load.

Figure joists and beams for the full live load.
Figure girders for 85 to 90 per cent of the live load.
Figure the columns supporting the roof and top story

of a building for the full live load. For each succeeding story below, make a reduction of 5 per cent in the full live

load coming on the columns. This reduction must however not exceed 50 per cent of the full live load for a story below, make a reduction of 5 per cent in the full live load coming on the columns. This reduction must however not exceed 50 per cent of the full live load for a

ever, not exceed 50 per cent of the full live load for a many stored building.

Figure the foundations for one-third of the full live load.

ULTIMATE AND SAFE STRENGTH OF MASONRY IN POUNDS PER SQUARE INCH.

MATERIAL	Compression			Safe Bearing	Modulus of Elasticity		Shear			Tension			Weight per Cubic Foot	
	Ultimate		Safe		Ultimate		Safe	Ultimate		Safe				
	From	To			From	To		From	To		From	To	From	To
	Av.	Av.	Av.		Av.	Av.	Av.	Av.	Av.	Av.	Av.	Av.	Av.	Av.
Hard Brick Work in P. C.	2000	3000	200	275	1,500,000	2,500,000	.....	.....	.....	100	200	20	130	150
Common " P. C.	1500	2500	175	250	1,500,000	2,500,000	150	300	20	100	200	20	110	130
" " N. C.	1000	2000	150	200	1,000,000	1,500,000	.....	.....	.....	50	100	10	110	130
" " L. M.	800	1600	100	150	500,000	1,000,000	.....	.....	.....	20	40	5	110	130
" " P. C. & L. M.	1000	2000	150	200	1,000,000	1,500,000	.....	.....	.....	50	100	10	110	130
Old Brick Work in P. C.	2000	3000	200	275	2,000,000	3,000,000	.....	.....	.....	120	250	25	110	130
" " N. C.	1500	2500	175	250	1,500,000	2,000,000	.....	.....	.....	70	120	15	110	130
" " L. M.	1000	2000	150	200	1,000,000	1,500,000	.....	.....	.....	25	50	7	110	130
Brick Piers in P. C.	1500	2500	175	250	1,500,000	2,500,000	.....	.....	.....	100	200	20	110	130
" " L. M.	800	1600	100	150	500,000	1,000,000	.....	.....	.....	20	40	5	110	130
Rubble Work in P. C.	1000	2000	150	200	1,500,000	2,500,000	.....	.....	.....	70	150	20	130	150
Coursed Rubble in P. C.	1500	2500	175	250	2,000,000	3,000,000	.....	.....	.....	100	200	20	140	160
Neat P. C.	2000	4000	200	300	1,500,000	3,000,000	1200	2400	300	400	800	70	80	90
Neat N. C.	1000	3000	175	250	1,000,000	2,000,000	700	1500	125	200	400	30	60	70
P. C. Mortar 1 : 3	1500	2500	175	250	1,000,000	2,000,000	200	400	35	200	400	30	120	130
N. C. Mortar 1 : 2	800	1500	150	200	800,000	1,500,000	150	300	25	100	200	20	120	130
Lime Mortar	200	400	100	150	500,000	800,000	50	100	10	20	40	5	90	110
P. C. Stone Concrete 1:2:4	1500	3500	400	500	1,500,000	3,500,000	800	1200	125	200	400	40	140	150
" " N. C. 1:2:5	1000	2000	200	300	1,000,000	2,000,000	500	1000	80	150	300	25	140	150
P. C. Cinder 1:2:5	800	1600	150	200	500,000	1,000,000	70	120	10	100	150	20	100	110
Granite	12000	20000	400	600	3,000,000	6,000,000	1200	2400	300	1200	2400	200	160	180
Limestone	6000	12000	350	500	2,000,000	5,000,000	1000	2000	175	1000	2000	175	150	170
Sandstone	5000	10000	300	400	1,000,000	3,000,000	800	1600	125	800	1600	125	140	160
Brick and Tile	2000	5000	200	300	1,000,000	3,000,000	500	1000	80	500	1000	80	120	140

PERCENTAGE OF HOOPING FOR VARIOUS CORE DIAMETERS AND HOOPING FOR HOOPED REINFORCED CONCRETE COLUMNS.

BY BENJ. E. WINSLOW, Mem. A. I. A. and Mem. Am. Soc. C. E.

Minimum No. of Rods	MAXIMUM PITCH OF SPIRALS TO BE NOT GREATER THAN 1/10 THE DIAM. OF COL. NOR GREATER THAN 3"														
	3/16" Hooping					5/16" Hooping					3/4" Hooping				
	1 3/8"	1 1/2"	1 5/8"	1 3/4"	1 3/8"	1 1/2"	1 5/8"	1 3/4"	1 3/8"	1 1/2"	2"	2 1/4"	2 1/2"	2 3/4"	3"
9	0.89	0.82	1.46												
10	0.80	0.74	1.31												
11	0.73	0.67	1.15												
12	0.67	0.61	1.09												
13	0.62	0.57	1.01	0.93	0.87	0.81	0.75	1.58	1.45	1.35	1.25	1.17	1.06	0.95	
14	0.57	0.53	0.94	0.87	0.81	0.75	0.70	1.46	1.35	1.25	1.17	1.09	0.98	0.88	
15	0.54	0.49	0.87	0.81	0.75	0.70	0.65	1.36	1.26	1.17	1.09	1.02	0.91	0.82	
16	0.50		0.82	0.76	0.70	0.66	0.61	1.28	1.18	1.10	1.02	0.96	0.85	0.77	
17	0.47		0.77	0.71	0.66	0.62	0.58	1.21	1.11	1.03	0.96	0.90	0.81	0.72	
18			0.73	0.67	0.63	0.58	0.54	1.14	1.05	0.97	0.91	0.85	0.76	0.68	
19			0.69	0.64	0.59	0.55	0.52	1.08	1.00	0.93	0.86	0.81	0.72	0.65	
20			0.66	0.61	0.56	0.52	0.49	1.02	0.95	0.88	0.82	0.76	0.68	0.61	
21			0.62	0.58	0.54	0.50		0.98	0.90	0.84	0.78	0.73	0.65	0.58	
22			0.60	0.55	0.51	0.48		0.93	0.86	0.80	0.75	0.70	0.62	0.56	
23			0.57	0.53	0.49			0.89	0.82	0.76	0.71	0.67	0.59	0.53	
24			0.55	0.50				0.85	0.79	0.73	0.68	0.64	0.57	0.51	
25			0.52	0.49				0.82	0.76	0.70	0.66	0.61	0.55	0.49	
26			0.50					0.79	0.73	0.67	0.63	0.59	0.53		
27			0.49					0.76	0.70	0.65	0.61	0.57	0.51		
28								0.73	0.68	0.63	0.59	0.55	0.49		
29								0.71	0.65	0.60	0.57	0.53			
30								0.68	0.63	0.58	0.55	0.51			
32								0.64	0.59	0.55	0.51	0.48			
34								0.60	0.56	0.52	0.48				
36								0.57	0.53	0.49					
38								0.54	0.50						
40								0.51	0.47						
42								0.50							
44								0.47							
46															
48															
50															
52															
54															

NOTE: Values inside of heavy lines are within the limits set by the Chicago Building Ordinance. See Sec. 546-567.

Hooping Rods												3/16" Hooping											
7/16" Hooping												1/2" Hooping											
Pitch	1 3/4"	1 3/8"	1 1/2"	1 1/4"	1 1/8"	1 1/16"	1 1/32"	3"	1 3/8"	1 1/2"	1 5/8"	2"	2 1/8"	2 1/4"	2 1/2"	2 3/4"	3"	1 3/8"	2"	2 1/4"	2 1/2"	2 3/4"	3"
16								1.50	1.37	1.25							1.53						
17								1.51	1.41	1.29	1.18						1.53						
18								1.57	1.48	1.33	1.22	1.11					1.59	1.45					
19								1.49	1.40	1.26	1.16	1.05					1.50	1.37					
20								1.60	1.51	1.41	1.33	1.29	1.10				1.57	1.43	1.30				
21								1.53	1.43	1.35	1.27	1.14	1.04	0.95			1.50	1.36	1.24				
22								1.56	1.46	1.37	1.29	1.22	1.09	1.00	0.91		1.59	1.43	1.30	1.18			
23								1.49	1.39	1.31	1.23	1.16	1.07	0.95	0.87		1.52	1.37	1.24	1.13			
24								1.43	1.34	1.25	1.18	1.11	1.00	0.91	0.83		1.54	1.45	1.31	1.19	1.09		1.51
25								1.37	1.28	1.20	1.13	1.07	0.96	0.88	0.80		1.57	1.48	1.40	1.26	1.14	1.04	
26								1.32	1.23	1.16	1.09	1.03	0.93	0.84	0.77		1.51	1.42	1.34	1.21	1.10	1.01	
27								1.27	1.19	1.11	1.05	0.99	0.89	0.81	0.74		1.55	1.45	1.37	1.29	1.16	1.06	0.97
28								1.23	1.15	1.07	1.01	0.96	0.86	0.77	0.72		1.60	1.50	1.40	1.32	1.25	1.12	1.02
29								1.18	1.10	1.04	0.98	0.92	0.83	0.75	0.69		1.55	1.44	1.35	1.27	1.20	1.08	0.99
30								1.14	1.07	1.00	0.94	0.89	0.80	0.73	0.67		1.50	1.40	1.31	1.23	1.16	1.05	0.95
31								1.07	1.00	0.95	0.88	0.84	0.75	0.68	0.63		1.40	1.31	1.23	1.15	1.09	0.98	0.89
32								1.01	0.94	0.88	0.83	0.79	0.71	0.64	0.59		1.32	1.23	1.15	1.09	1.02	0.97	0.87
33								0.95	0.89	0.83	0.79	0.74	0.67	0.61	0.56		1.25	1.16	1.09	1.02	0.97	0.87	0.79
34								0.90	0.84	0.79	0.75	0.70	0.63	0.58	0.53		1.18	1.10	1.03	0.97	0.92	0.83	0.75
35								0.86	0.80	0.75	0.71	0.67	0.60	0.55	0.50		1.12	1.05	0.98	0.92	0.87	0.79	0.71
36								0.82	0.76	0.72	0.67	0.64	0.57	0.52	0.48		1.07	1.00	0.94	0.88	0.83	0.75	0.68
37								0.78	0.73	0.68	0.64	0.61	0.55	0.50			1.02	0.95	0.89	0.84	0.79	0.71	0.65
38								0.75	0.70	0.65	0.62	0.59	0.52	0.49			0.98	0.91	0.85	0.80	0.76	0.68	0.62
39								0.72	0.67	0.63	0.59	0.56	0.50				0.94	0.87	0.82	0.77	0.73	0.65	0.60
40								0.69	0.64	0.60	0.57	0.54	0.48				0.90	0.84	0.79	0.74	0.70	0.63	0.57
41								0.66	0.62	0.58	0.54	0.51					0.86	0.80	0.75	0.71	0.67	0.60	0.55
42								0.64	0.59	0.56	0.52	0.49					0.83	0.78	0.73	0.68	0.65	0.58	0.53
43								0.61	0.57	0.54	0.50						0.80	0.75	0.70	0.66	0.62	0.56	0.51
44								0.57	0.53	0.50	0.47						0.75	0.70	0.65	0.62	0.58	0.52	
45								0.54	0.50	0.47													
46								0.51	0.47														
47								0.48															
48								0.45															
49								0.42															
50								0.39															
51								0.36															
52								0.33															
53								0.30															
54								0.27															
55								0.24															
56								0.21															
57								0.18															
58								0.15															
59								0.12															
60								0.09															

TABLE I.

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Safe Extreme Fiber Stresses for Reinforced Concrete Beams in Accordance with the Chicago Building Ordinance Requirements for Concrete of Various Mixtures and Various Safe Stresses in the Steel Reinforcement. Straight Line Theory.

BY BENJ. E. WINSLOW, Mem. A. I. A. and Mem. Am. Soc. C. E.

Percentage of tensile reinforcing.	Mixture of concrete. Stone.					Stress in steel.	
	1:1.2.	1:1½:3.	1:2:4.	1:2½:5.	1:3:7.	16000.	18000.
0.00	58	48	40	35	30	0	0
0.01	11	11	11	11	11	9	11
0.02	21	21	21	21	21	19	21
0.03	31	31	31	31	31	28	31
0.04	41	41	41	41	41	37	42
0.05	50	50	50	50	50	45	50
0.06	60	60	60	60	60	55	60
0.07	70	70	70	70	70	65	70
0.08	80	80	80	80	80	70	80
0.09	90	90	90	90	90	80	90
0.10	100	100	100	100	100	90	100
0.11	115	115	115	110	110	100	115
0.12	125	125	125	120	120	110	125
0.13	135	135	135	130	130	120	135
0.14	145	145	145	140	140	125	145
0.15	150	150	150	145	145	135	150
0.16	160	160	160	155	155	145	160
0.17	170	170	170	165	165	150	170
0.18	180	180	180	175	175	160	180
0.19	190	190	190	185	185	170	190
0.20	205	205	205	200	200	180	205
0.22	220	220	220	215	215	195	220
0.24	240	240	240	235	235	210	240
0.26	260	260	260	250	250	230	260
0.28	280	280	275	270	270	245	275
0.30	300	300	295	295	290	265	295
0.32	320	320	315	315	310	280	315
0.34	335	335	330	330	325	295	330
0.36	355	355	350	350	345	310	350
0.38	375	375	370	370	365	330	375
0.40	395	395	390	390	385	345	390
0.42	415	415	410	400	400	365	410
0.44	430	430	425	420	420	380	425
0.46	450	450	445	440	440	395	445
0.48	470	470	465	460	455	410	465
0.50	490	485	480	475	470	430	480
0.52	510	505	500	495	490	445	515
0.54	525	520	515	510	505	460	515
0.56	545	540	535	530	515	480	535
0.58	565	560	555	550	520	495	555
0.60	585	580	575	570	530	510	575
0.62	600	595	590	585	535	525	595
0.64	620	615	610	595	540	540	610
0.66	640	635	630	600	540	560	630
0.68	660	655	650	605	545	575	650
0.70	675	670	665	610	550	590	665
0.72	695	690	680	620	555	605	670
0.74	715	710	685	625	560	620	700
0.76	730	725	690	630	565	635	720
0.78	750	745	695	635	570	655	735
0.80	770	760	700	635	575	670	755
0.82	790	780	710	640	580	685	770
0.84	805	795	715	650	585	700	790
0.86	820	805	720	655	590	715	805
0.88	840	810	725	660	595	730	825
0.90	860	815	730	660	600	750	840
0.92	875	820	735	665	600	765	860

See note on following page.

Percentage of tensile reinforcing.	Mixture of concrete. Stone.					Stress in steel.	
	1:1.2.	1:1½:3.	1:2:4.	1:2½:5.	1:3:7.	16000.	18000.
0.94	895	825	740	670	605	780	875
0.96	920	835	745	675	610	795	895
0.98	930	840	750	680	615	810	910
1.00	950	845	755	685	620	825	930
1.1	980	870	780	700	635	905	1015
1.2	1010	895	800	720	650	980	1105
1.3	1030	920	815	740	660	1055	1190
1.4	1055	940	835	750	680	1135	1275
1.5	1080	960	850	760	690	1205	1360
1.6	1100	980	865	780	695	1285	1445
1.7	1120	995	880	790	710	1355	1530
1.8	1140	1010	895	800	720	1435	1610
1.9	1160	1025	905	810	725	1505	1695
2.0	1175	1040	920	830	740	1580	1780
2.5	1250	1090	965	865	775	1945	2190
3.0	1310	1150	1010	895	800	2305	2590
3.5	1360	1190	1040	925	820	2660	2990
4.0	1405	1220	1070	950	840	3010	3385
4.5	1440	1250	1090	965	860	3355	3770
5.0	1470	1280	1110	980	870	3700	4165

TABLE II.

Ultimate Extreme Fiber Stresses for Concrete Beams Reinforced with High Carbon Steel—Straight Line Theory.

By L. J. MENSCH, Mem. Am. Soc. C. E.

% tensile steel.	Ultimate Compressive Strength Obtained from Cylinder Tests.					
	2900	2400	2000	1750	1500	700
	1:1.2	1:1½:3	1:2:4	1:2½:5	1:3:7	
0.25	1040	1030	1020	1010	1010	960
0.30	1240	1230	1220	1200	1190	1080
0.35	1430	1420	1400	1380	1370	1200
0.40	1630	1610	1580	1560	1550	1330
0.45	1820	1800	1760	1740	1710	1440
0.50	2010	1970	1940	1900	1870	1540
0.55	2190	2150	2110	2060	2030	1620
0.60	2370	2330	2280	2230	2170	1700
0.65	2540	2500	2440	2370	2310	1800
0.70	2720	2650	2600	2520	2450	1800
0.75	2900	2820	2740	2660	2590	1800
0.80	3070	2990	2900	2800	2720	1800
0.85	3240	3150	3040	2930	2830	1800
0.90	3400	3300	3180	3060	2950	1800
0.95	3560	3440	3320	3200	3050	1800
1.00	3700	3570	3450	3310	3160	1800
1.10	4020	3860	3700	3520	3350	1800
1.20	4300	4120	3930	3730	3510	1800
1.30	4600	4380	4140	4000	3600	1800
1.40	4860	4610	4330	4000	3600	1800
1.50	5120	4820	4520	4000	3600	1800
1.60	5370	5050	4600	4000	3600	1800
1.70	5600	5250	4600	4000	3600	1800
1.80	5820	5450	4600	4000	3600	1800
1.90	6040	5600	4600	4000	3600	1800
2.00	6260	5750	4600	4000	3600	1800
2.25	6700	5800	4600	4000	3600	1800

TABLE III.

Copyright 1916 by Benj. E. Winslow.

Safe Extreme Fiber Stresses in Pounds per Square Inch for Double Reinforced Concrete Beams for Various Percentages of Top and Bottom Steel. Straight Line Theory.

BY BENJ. E. WINSLOW, Mem. A. I. A. and Mem. Am. Soc. C. E.

Maximum Compression on Extreme Fiber of Concrete=700 Lbs. per Sq. In. Maximum Tension in Steel Reinforcement=18000 Lbs. per Sq. In. Mixture of Concrete 1:2:4. Ratio of Modulus of Elasticity of Steel to That of Concrete=15. Ratio of Depth of Top Steel to Depth of Bottom Steel Below Top of Beam=0.10. Values for Other Steel and Concrete Stresses Are Directly Proportionate to Those Given in This Table.

		Percentage of Compressive Steel														
		0.00	0.10	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	
Percentage of Tensile Steel	0.60	575	578	579	580	581	582	583	584	584	585	586	587	588	589	0.60
	0.62	595	596	597	599	600	601	602	603	604	605	606	607	608	609	0.62
	0.64	610	612	613	615	616	618	619	621	622	624	625	627	628	629	0.64
	0.66	630	632	633	635	636	638	639	641	642	644	645	647	648	649	0.66
	0.68	650	652	653	655	656	658	659	661	662	663	665	666	667	668	0.68
	0.70	665	667	668	670	671	673	674	676	677	678	680	682	684	686	0.70
	0.72	680	688	689	691	693	694	696	697	699	700	702	703	705	706	0.72
	0.74	685	704	706	707	709	710	712	713	715	716	718	719	721	723	0.74
	0.76	690	720	726	728	729	731	732	734	735	737	738	740	741	743	0.76
	0.78	695	726	744	746	747	749	750	752	753	755	757	759	761	763	0.78
	0.80	700	731	762	764	766	768	770	772	774	776	778	780	781	783	0.80
	0.82	710	739	779	782	784	786	788	790	792	794	796	798	800	802	0.82
	0.84	715	743	790	800	802	804	806	808	810	812	814	816	818	821	0.84
	0.86	720	750	795	820	822	824	826	828	830	832	834	836	838	840	0.86
	0.88	725	755	800	839	842	844	846	848	850	852	854	856	858	860	0.88
	0.90	730	760	807	858	861	863	866	868	870	872	874	876	878	880	0.90
	0.92	735	765	812	873	880	883	885	887	890	892	894	896	898	900	0.92
	0.94	740	770	818	888	900	902	904	906	908	910	912	914	916	918	0.94
	0.96	745	775	823	892	920	922	924	926	928	930	932	934	935	937	0.96
	0.98	750	780	828	900	938	940	942	944	946	948	950	952	954	956	0.98
1.00	755	786	832	905	956	958	960	962	964	967	969	972	974	976	1.00	
1.10	780	811	853	930	1010	1060	1061	1063	1065	1066	1068	1069	1071	1072	1.10	
1.20	800	828	874	954	1031	1105	1155	1157	1159	1161	1163	1165	1167	1170	1.20	
1.30	815	850	895	978	1058	1130	1210	1252	1254	1256	1258	1260	1262	1265	1.30	
1.40	835	869	916	1006	1076	1156	1232	1310	1345	1348	1351	1354	1358	1362	1.40	
1.50	850	882	935	1020	1100	1178	1255	1331	1410	1450	1452	1455	1457	1460	1.50	
1.60	865	899	950	1034	1115	1196	1276	1352	1435	1511	1547	1550	1553	1555	1.60	
1.70	880	913	967	1054	1130	1215	1296	1374	1455	1538	1630	1650	1652	1655	1.70	
1.80	895	928	983	1064	1149	1232	1316	1394	1480	1560	1645	1710	1747	1750	1.80	
1.90	905	940	995	1082	1162	1250	1332	1414	1500	1580	1665	1725	1830	1848	1.90	
2.00	920	952	1008	1100	1178	1266	1350	1432	1513	1600	1680	1760	1840	1918	2.00	
2.50	965	1004	1055	1152	1241	1331	1420	1510	1595	1686	1715	1855	1945	2026	2.50	
3.00	1010	1048	1105	1196	1291	1385	1480	1570	1660	1750	1840	1930	2020	2108	3.00	
3.50	1040	1080	1140	1234	1334	1427	1515	1615	1705	1806	1890	1990	2080	2174	3.50	
4.00	1070	1115	1170	1266	1366	1464	1560	1665	1755	1852	1940	2040	2130	2230	4.00	
4.50	1090	1145	1205	1295	1395	1500	1595	1700	1795	1888	1980	2080	2180	2278	4.50	
5.00	1110	1160	1235	1315	1415	1525	1620	1730	1825	1924	2020	2120	2220	2318	5.00	

For values above heavy line, tension in steel is equal to 18000 lbs. per square inch.

For values below heavy lines compression in concrete is equal to 700 lbs. per square inch.

Values for other steel and concrete stresses are directly proportional to those given in Tables I and III.

Table I gives the Extreme Fiber Stress for rectangular reinforced concrete beams for various mixtures of concrete and stresses in the steel for percentages of steel varying from plain concrete beams, to beams reinforced with as high as 5% of steel.

In Table II are given in the headings the ultimate compressive strength of concrete for various concrete mixtures. According to the theory of Mr. L. J. Mensch as published in the Journal of the American Concrete Institute for December, 1914, these compressive strengths, if introduced in the straight line formula do not agree with scientific tests on reinforced concrete beams to rupture. In order to make the straight line theory agree with the tests at rupture the ultimate extreme fiber stresses as given in Table II must be assumed instead of the values given in the headings.

The value 700 in the heading is for 1:2:4 cinder*-concrete. It is also valid for stone concrete a few days old. The depth of the reinforced-concrete beams is of course assumed to be the depth to the center of the steel. Tables I, II and III assume only pure tension or compression failures. Special calculations should therefore be made for bond, shear and diagonal tension.

Table III gives the Extreme Fiber Stress for rectangular Double Reinforced concrete beams, for various percentages of tensile and compressive steel.

ULTIMATE AND SAFE STRENGTH OF IRON AND STEEL IN POUNDS PER SQUARE INCH

Material	Compression			Safe Bearing	Shear			Modulus of Elasticity		Weight per Cu. Ft.
	Ultimate		Safe Average		Ultimate		Ultimate			
	From	To			From	To	From	To		
Hard Steel	36,000	40,000	18,000	26,000	45,000	55,000	12,000	28,000,000	31,000,000	490
Medium Steel	33,000	38,000	16,000	24,000	50,000	60,000	12,000	"	"	"
Steel Pins	33,000	38,000	16,000	24,000	50,000	60,000	12,000	"	"	"
Shop Rivets	24,000	29,000	16,000	24,000	50,000	60,000	12,000	"	"	"
Field Rivets	24,000	29,000	12,000	20,000	50,000	60,000	10,000	"	"	"
Cast Steel	60,000	90,000	12,000	26,000	50,000	60,000	12,000	29,000,000	32,000,000	"
Cast Iron	60,000	90,000	10,000	15,000	15,000	25,000	2,000	12,000,000	18,000,000	450

Material	Extreme Fiber Stress			Tension			Elastic Limit		Modulus of Resilience
	Ultimate		Safe Average	Ultimate		Ultimate			
	From	To		From	To	From	To		
Hard Steel	50,000	70,000	18,000	65,000	75,000	18,000	35,000	45,000	35
Medium Steel	40,000	60,000	16,000	60,000	70,000	16,000	30,000	40,000	35
Steel Pins	40,000	60,000	24,000	60,000	70,000	16,000	30,000	40,000	
Shop Rivets	40,000	60,000	24,000	48,000	58,000		24,000	30,000	
Field Rivets	40,000	60,000	18,000	46,000	54,000		24,000	30,000	
Cast Steel	60,000	90,000	16,000			18,000	35,000	50,000	
Cast Iron	30,000	40,000	3,500			3,000	10,000	20,000	1.2

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ENGINEERING DESIGN FOR WOOD STRUCTURES

Recommended by the Forest Products Laboratory, United States Forest Service for Grades Complying with Basic Provisions for Structural Grades of American Lumber Standards.

NOTES ON WORKING STRESSES.

1. **THE WORKING STRESSES** in the accompanying table are recommended by the Forest Products Laboratory, U. S. Forest Service, for structural grades complying with Basic provisions for Structural Material of American Lumber Standards. In Beam and Stringer, and Post and Timber grades, stresses are given only for the species commonly cut to those sizes. Stresses for any other species can be obtained from the Forest Products Laboratory.

2. **STRUCTURAL GRADES** are developed to insure minimum strength values. The defects permitted in the Common grades provide material having not less than 60 per cent of the strength of green clear wood, and in the select grades, of 75 per cent, although in Douglas fir and Southern pine the stresses recommended in compression and in extreme fiber in bending are 80 per cent of green clear wood strength on account of the limitation on rate of growth.

3. **WORKING VALUES** are given for three conditions of exposure during use: (a) Continuously dry, (b) Occasionally wet but quickly dried, (c) More or less continuously damp or wet. Judgment should be exercised as to the values to be used in a particular case.

(a) **Continuously dry** contemplates use in interior or protected construction, not subject to conditions of excessive dampness or high humidity.

(b) **Occasionally wet** but quickly dried assumes use in such exterior structures as bridges, trestles, grandstands or bleachers, and exposed framework of open sheds.

(c) **More or less continuously damp or wet** would apply to material exposed to waves or tidewater, or in contact with earth, or used in a building in portions that would be more or less continuously wet.

4. **THE WORKING STRESS** recommended may be used without allowance for impact up to 100%.

5. **WORKING VALUES GIVEN FOR HORIZONTAL SHEAR** are maximum values. The maximum unit horizontal shear at any point in a beam as calculated is 3/2 of the average unit shear obtained by dividing the total shear at that point by the area of the cross section.

6. **RECOGNITION OF ALL LOADS IN DESIGNING FOR MOVING LOADS**, or loads concentrated near a support, gives a calculated shearing stress higher than is actually developed. In calculating the shear at one end of a beam, the concentrated loads between this end and a point distant three times the depth of the beam from the support may be considered as acting at this point. In moving loads, as on highway

bridges or railway stringers, in computing the shear at one end it is safe to ignore all wheel loads between that end and a point three times the depth of the beam or stringer from it, when the balance of the span is assumed loaded so as to give a maximum shear stress.

7. **SHEAR STRESSES FOR JOINT DETAILS** may be taken as 50 per cent greater than the values for horizontal shear given in the table.

8. **TIMBER CONSTANTLY YIELDS UNDER LONG CONTINUED LOADING**, acquiring a permanent set. This set with a fully loaded beam is about equal to the deflection using the modulus of elasticity as given in the tables. In order to minimize the results of sag, it is advisable to use values one-half those given in the tables.

9. **THE WORKING STRESSES FOR COMPRESSION PARALLEL TO GRAIN** are for use on posts, struts, etc., with unsupported length not greater than ten times their least dimension. They are also for use in end bearing on compression members, as a short column or strut is more likely to fail at the end than at any other point in its length, and the variations in moisture content are greater there.

10. **FOR COLUMNS OF INTERMEDIATE LENGTH**, the Forest Products Laboratory finds from tests recently made that a fourth-power parabola, tangent to the Euler curve, is a conservative representation of the law controlling the strength. That is, from the short block to the long column in which the strength is dependent on stiffness, there is a falling off in ultimate strength which follows a smooth curve, very flat at first but curving sharply to become tangent to the Euler curve at two-thirds of the ultimate crushing strength.

11. **For columns from**

$$\frac{P}{A} = S \text{ to } \frac{P}{A} = \frac{2}{3} S.$$

$$\frac{P}{A} = S \left[1 - \frac{1}{3} \left(\frac{l}{Kd} \right)^4 \right]$$

Where P = Total load in pounds.

A = Area in square inches.

$\frac{P}{A}$ = Unit of compressive stress.

S = Safe stress in compression parallel to grain.

l = Unsupported length in inches.

d = Least dimension in inches.

E = Modulus of elasticity.

K = The $\frac{l}{d}$ at the point of tangency of the parabolic and Euler curves, at which

$$\frac{P}{A} = \frac{2}{3} S. \text{ The value of K for any}$$

species and grade is

$$\frac{\pi}{2} \sqrt{\frac{E}{6S}}$$

12. THE INFLUENCE OF DEFECTS ON THE COMPRESSIVE STRENGTH OF COLUMNS of constant cross section decreases as the length increases.

When $\frac{1}{d}$ equals the value of K for the species and grade, defects such as are allowable in the grade have little influence on the strength as a column. Beyond this length the investigation of the strength of columns indicated that the Euler formula is quite accurate for long wooden columns with pin-end connections and that the maximum load is dependent upon stiffness. In such columns, a factor of safety of 3 should be applied to values of modulus of elasticity in order to obtain safe loading.

13. SQUARE END COLUMNS. The Laboratory does not, with the present data and under ordinary conditions, find justification for increasing the stresses on square-end columns over those for carefully centered pin-end columns. Tests to determine the influence of end conditions are still being made and it is probable that under special conditions higher stresses can be used.

14. FOR LONG COLUMNS, including factor of safety of 3:

$$\frac{P}{A} = \frac{\pi^2 E}{36 \left(\frac{l}{d} \right)^2}$$

15. COLUMNS SHOULD BE LIMITED IN SLENDERNESS to $\frac{l}{d} = 50$.

16. FOR DIRECT TENSION the same values as for extreme fiber stress in bending may be used. Straight grained wood has greater resistance to tension than to any other kind of stress. It has been found, however, practically impossible to design joints that will develop anywhere nearly the full tensile strength.

17. GRADES OF JOISTS OR BEAMS may be used for members in direct tension, as in bottom chords of trusses, increase in size of defects towards ends being permissible because of the gradual application of stresses through splice plates or end connections.

18. THE PROVISIONS OF THE JOIST AND PLANK GRADE are such that working stresses for these grades may be applied to material used with the wide faces vertical or horizontal. In material 5-inch and thicker with loads applied to the wide face, the knot requirements for this face are those for the narrow face as given in the rules.

19. WHERE WORKING STRESSES IN BENDING ARE REQUIRED FOR CAPS, BRIDGE TIES, ETC., they should be graded on Beam and Stringer grades, but as such material is often square or has horizontal faces wider than the vertical faces, in contrast to beams and stringers, in which the

narrow faces are horizontal faces and the wide faces are vertical, care should be exercised that the knot limitations are applied to the proper faces.

20. IN RAILWAY STRINGERS OF TWO SPANS LENGTH, DEFECTS THROUGHOUT THE CENTER TWO-THIRDS SHOULD BE LIMITED as in the center third of a single span stringer, for the maximum moment will be over the center support and although the full positive moment would not be developed in either span as long as there was resistance to negative moment over the center support, there might be circumstances in which full positive moment of resistance at the centers of the two spans would be desirable.

21. IN DETERMINING WORKING STRESSES the Forest Products Laboratory has considered both elastic limit and breaking strength. Elastic limit, however, is more variable and less definite than ultimate strength, and the latter is taken as the more dependable basis for the determination of safe working stresses.

22. THE FACTOR OF SAFETY AT A GIVEN WORKING STRESS VARIES MATERIALLY WITH THE DURATION OF THE STRESS. At the recommended working stresses, the average timber in buildings has a factor of safety of 6 on impact loading, 4 under 5-minute loads and $2\frac{1}{2}$ under long-time loading, with a minimum factor of safety of 2 on 75 per cent of the pieces under long-time loading, while about one piece in 100, of very light weight and with maximum defects for the grade, would be expected to break at $1\frac{1}{2}$ times the recommended stress under loading of approximately 10 years' duration. The factor of safety on new timbers in bridge work is about $1\frac{1}{7}$ greater than the above values.

23. WORKING STRESSES ARE BASED ON THE STRENGTH OF THE CLEAR WOOD of the various species and, in some properties, on grade as fixed by limitation on size and location of knots, extent of shake and checks, and extent of cross grain, on conditions of exposure during use, and on size of piece. In southern pine and Douglas fir, working stresses in some properties are increased for limitation on rate of growth and for requirement of percentage of summerwood.

24. WORKING STRESSES FOR EXTREME FIBER IN BENDING are varied with grade, extent of exposure and size of piece; in horizontal shear, they are varied with grade; in compression parallel to grain, with grade and exposure; in compression perpendicular to grain, with exposure.

25. WORKING STRESSES IN SHEAR are not varied with size or extent of exposure; in compression parallel to grain they are not varied with size; in compression perpendicular to grain they are not varied with grade or size; in modulus of elasticity they are taken as the same in all grades.

26. **IN SOUTHERN PINE AND DOUGLAS FIR, WORKING STRESSES** in extreme fiber in bending, compression parallel to grain and compression perpendicular to grain, in any grade, may be increased 1/15 for material of close grain, or 1/6 for dense mate-

rial, over material not so selected. Values in these species in shear may be increased 1/6 for dense material, but not for limitation on rate of growth. Modulus of elasticity is not varied with these properties.

27. **VARIATION IN WORKING STRESSES.**

x varies with
— does not vary with

Property	Governing Defects	Conditions of Exposure	Grade	Size of Piece	Rate of Growth	Density
Extreme Fiber in Bending	Knots and Slope of Grain	x	x	x*	x	x
Horizontal Shear	Shake and Checks	—	x	—	—	x
Compression Parallel	Knots and Slope of Grain	x	x	—	x	x
Compression Perpendicular		x	—	—	x	x
Modulus of Elasticity		—	—	—	—	—

* Dry Location only.

WORKING STRESSES IN POUNDS PER SQUARE INCH FOR POSTS AND TIMBERS,

6"x6" AND LARGER.

CONTINUOUSLY DRY.

Select Grade.

SPECIES	RATIO OF LENGTH TO LEAST DIMENSION (L/D)										MODULUS OF ELASTICITY	
	10	12	14	16	18	20	25	30	35	40		50
Cedar, Western Red.....	700	686	674	656	629	592	438	304	224	171	110	1,000,000
Douglas Fir, Coast Region: Select.....	1175	1149	1127	1093	1045	975	702	487	358	274	175	1,600,000
Dense Select.....	1285	1251	1222	1176	1112	1022	702	487	358	274	175	1,600,000
Rocky Mountain Region.....	800	786	774	753	726	688	526	365	268	206	132	1,200,000
Hemlock, West Coast.....	900	885	872	852	823	783	614	426	313	240	153	1,400,000
Larch, Western.....	1100	1068	1041	999	937	851	570	396	291	223	142	1,300,000
Pine, Southern: Select.....	1175	1149	1127	1093	1045	975	702	487	358	274	175	1,600,000
Dense Select.....	1285	1251	1222	1176	1112	1022	702	487	358	274	175	1,600,000
Redwood.....	1000	972	947	910	856	781	526	365	268	206	132	1,200,000
Spruce, Red, White, Sitka.....	800	786	774	753	726	688	526	365	268	206	132	1,200,000

Common Grade.

Cedar, Western Red	560	553	547	538	524	505	425	304	224	171	110	1,000,000
Douglas Fir, Coast Region	880	870	861	847	826	796	675	487	358	274	175	1,600,000
Rocky Mountain Region	640	632	627	617	602	582	500	365	268	206	132	1,200,000
Hemlock, West Coast	720	712	706	696	680	660	573	426	313	240	153	1,400,000
Larch, Western	880	863	849	828	798	752	570	396	291	223	142	1,300,000
Pine, Southern	880	870	861	847	826	796	675	487	358	274	175	1,600,000
Redwood	800	786	773	754	726	688	526	365	268	206	132	1,200,000
Spruce, Red, White, Sitka	640	632	627	617	602	582	500	365	268	206	132	1,200,000

WORKING STRESSES IN POUNDS PER SQUARE INCH FOR POSTS AND TIMBERS.

6"x6" AND LARGER.

OCCASIONALLY WET BUT QUICKLY DRIED.

Select Grade.

SPECIES	RATIO OF LENGTH TO LEAST DIMENSION (L/D)											MODULUS OF ELASTICITY
	10	12	14	16	18	20	25	30	35	40	50	
Cedar, Western Red.....	700	686	673	654	626	588	438	304	224	171	110	1,000,000
Douglas Fir, Coast Region: Select.....	1065	1045	1028	1003	968	915	702	487	358	274	175	1,600,000
Dense Select.....	1165	1139	1118	1083	1036	967	702	487	358	274	175	1,600,000
Rocky Mountain Region.....	800	785	772	753	728	688	526	365	268	206	132	1,200,000
Hemlock, West Coast.....	900	885	871	851	824	783	612	426	313	240	153	1,400,000
Larch, Western.....	1000	976	955	922	877	810	570	396	291	223	142	1,300,000
Pine, Southern: Select.....	1065	1045	1028	1003	968	915	702	487	358	274	175	1,600,000
Dense Select.....	1165	1139	1118	1083	1036	967	702	487	358	274	175	1,600,000
Redwood.....	900	879	861	834	794	738	526	365	268	206	132	1,200,000
Spruce, Red, White, Sitka.....	750	738	728	712	690	660	525	365	268	206	132	1,200,000

Common Grade.

Cedar, Western Red.....	560	552	546	537	523	504	425	304	224	171	110	1,000,000
Douglas Fir, Coast Region.....	800	792	784	773	758	736	634	487	358	274	175	1,600,000
Rocky Mountain Region.....	640	632	625	616	602	582	502	365	268	206	132	1,200,000
Hemlock, West Coast.....	720	712	705	695	681	659	572	426	313	240	153	1,400,000
Larch, Western.....	800	787	777	760	736	704	564	396	291	223	142	1,300,000
Pine, Southern.....	800	792	784	773	758	736	634	487	358	274	175	1,600,000
Redwood.....	720	709	700	685	666	637	518	365	268	206	132	1,200,000
Spruce, Red, White, Sitka.....	600	594	588	580	568	552	483	365	268	206	132	1,200,000

MORE OR LESS CONTINUOUSLY DAMP OR WET.

Select Grade.

SPECIES	RATIO OF LENGTH TO LEAST DIMENSION (L/D)											MODULUS OF ELASTICITY
	10	12	14	16	18	20	25	30	35	40	50	
Cedar, Western Red.....	650	638	629	614	594	565	442	304	224	171	110	1,000,000
Douglas Fir, Coast Region: Select.....	905	893	883	867	846	814	683	487	358	274	175	1,600,000
Dense Select.....	990	974	961	940	910	871	698	487	358	274	175	1,600,000
Rocky Mountain Region.....	700	690	681	669	651	623	511	365	268	206	132	1,200,000
Hemlock, West Coast.....	800	789	780	766	745	717	600	426	313	240	153	1,400,000
Larch, Western.....	800	787	776	760	736	704	560	396	291	223	142	1,300,000
Pine, Southern: Select.....	905	893	883	867	846	814	683	487	358	274	175	1,600,000
Dense Select.....	990	974	961	940	910	871	698	487	358	274	175	1,600,000
Redwood.....	750	737	727	712	690	660	525	365	268	206	132	1,200,000
Spruce, Red, White, Sitka.....	650	642	635	625	611	589	500	365	268	206	132	1,200,000

Common Grade.

Cedar, Western Red.....	520	514	509	502	491	475	413	304	224	171	110	1,000,000
Douglas Fir, Coast Region.....	680	675	670	664	655	644	588	482	358	274	175	1,600,000
Rocky Mountain Region.....	560	551	544	535	524	505	465	365	268	206	132	1,200,000
Hemlock, West Coast.....	640	634	629	622	612	598	537	426	313	240	153	1,400,000
Larch, Western.....	640	633	627	618	606	588	515	396	291	223	142	1,300,000
Pine, Southern.....	680	675	670	664	655	644	588	482	358	274	175	1,600,000
Redwood.....	600	594	588	580	568	552	483	365	268	206	132	1,200,000
Spruce, Red, White, Sitka.....	520	515	512	507	500	489	446	365	268	206	132	1,200,000

**WORKING STRESSES IN POUNDS PER SQUARE INCH FOR JOIST AND PLANK,
BEAMS AND STRINGERS.**

CONTINUOUSLY DRY.

Select Grade.

SPECIES	EXTREME FIBER IN BENDING	COMPRESSION PERPENDICULAR TO GRAIN	MAXIMUM HORIZONTAL SHEAR	MODULUS OF ELASTICITY
Cedar, Western Red.....	900	200	80	1,000,000
Northern and Southern White.....	750	175	70	800,000
Port Orford.....	1100	250	90	1,200,000
Alaska.....	1100	250	90	1,200,000
Cypress, Southern.....	1300	350	100	1,200,000
Douglas Fir, Coast Region: Select.....	1600	345	90	1,600,000
Dense Select.....	1750	380	105	1,600,000
Rocky Mountain Region.....	1100	275	85	1,200,000
Fir, Balsam.....	900	150	70	1,000,000
Golden, Noble, Silver, White.....	1100	300	70	1,100,000
Hemlock, West Coast.....	1300	300	75	1,400,000
Eastern.....	1100	300	70	1,100,000
Larch, Western.....	1200	325	100	1,300,000
Pine, Southern: Select.....	1600	345	110	1,600,000
Dense Select.....	1750	380	128	1,600,000
California, Idaho and Northern White,				
Pondosa and Sugar.....	900	250	85	1,000,000
Norway.....	1100	300	85	1,200,000
Redwood.....	1200	250	70	1,200,000
Spruce, Red, White, Sitka.....	1100	250	85	1,200,000
Englemann.....	750	175	70	800,000
Tamarack, Eastern.....	1200	300	95	1,300,000

Common Grade.

Cedar, Western Red.....	720	200	64	1,000,000
Northern and Southern White.....	600	175	56	800,000
Port Orford.....	880	250	72	1,200,000
Alaska.....	880	250	72	1,200,000
Cypress, Southern.....	1040	350	80	1,200,000
Douglas Fir, Coast Region.....	1200	325	72	1,600,000
Rocky Mountain Region.....	880	275	68	1,200,000
Fir, Balsam.....	720	150	56	1,000,000
Golden, Noble, Silver, White.....	880	300	56	1,100,000
Hemlock, West Coast.....	1040	300	60	1,400,000
Eastern.....	880	300	56	1,100,000
Larch, Western.....	960	325	80	1,300,000
Pine, Southern.....	1200	325	88	1,600,000
California, Idaho and Northern White,				
Pondosa and Sugar.....	720	250	68	1,000,000
Norway.....	880	300	68	1,200,000
Redwood.....	960	250	56	1,200,000
Spruce, Red, White, Sitka.....	880	250	68	1,200,000
Englemann.....	600	175	56	800,000
Tamarack, Eastern.....	960	300	76	1,300,000

**WORKING STRESSES IN POUNDS PER SQUARE INCH FOR JOISTS, PLANK
BEAMS AND STRINGERS.**

MORE OR LESS CONTINUOUSLY DAMP OR WET.

Select Grade.

SPECIES	EXTREME FIBER IN BENDING		COMPRESSION PERPENDICULAR TO GRAIN	MAXIMUM HORIZONTAL SHEAR	MODULUS OF ELASTICITY
	4" and Thinner	5" and Thicker			
Cedar, Western Red.....	670	750	125	80	1,000,000
Northern and Southern White.....	530	...	100	70	800,000
Port Orford.....	800	900	150	90	1,200,000
Alaska.....	800	...	150	90	1,200,000
Cypress, Southern.....	800	...	225	100	1,200,000
Douglas Fir, Coast Region: Select.....	950	1065	215	90	1,600,000
Dense Select.....	1050	1165	235	105	1,600,000
Rocky Mountain Region.....	620	700	200	85	1,200,000
Fir, Balsam.....	530	...	100	70	1,000,000
Golden, Noble, Silver, White.....	710	...	200	70	1,100,000
Hemlock, West Coast.....	800	900	200	75	1,400,000
Eastern.....	710	...	200	70	1,100,000
Larch, Western.....	800	900	200	100	1,300,000
Pine, Southern: Select.....	950	1065	215	110	1,600,000
Dense Select.....	1050	1165	235	128	1,600,000
California, Idaho and Northern White, Pondosa and Sugar.....	670	...	125	85	1,000,000
Norway.....	710	...	150	85	1,200,000
Redwood.....	710	800	125	70	1,200,000
Spruce, Red, White, Sitka.....	710	800	125	85	1,200,000
Englemann.....	440	...	100	70	800,000
Tamarack, Eastern.....	800	...	200	95	1,300,000

Common Grade.

Cedar, Western Red.....	570	600	125	64	1,000,000
Northern and Southern White.....	450	...	100	56	800,000
Port Orford.....	680	720	150	72	1,200,000
Alaska.....	680	...	150	72	1,200,000
Cypress, Southern.....	680	...	225	80	1,200,000
Douglas Fir, Coast Region.....	750	800	200	72	1,600,000
Rocky Mountain Region.....	530	560	200	68	1,200,000
Fir, Balsam.....	450	...	100	56	1,000,000
Golden, Noble, Silver, White.....	600	...	200	56	1,100,000
Hemlock, West Coast.....	680	720	200	60	1,400,000
Eastern.....	600	...	200	56	1,100,000
Larch, Western.....	680	720	200	80	1,300,000
Pine, Southern.....	750	800	200	88	1,600,000
California, Idaho and Northern White, Pondosa and Sugar.....	570	...	125	68	1,000,000
Norway.....	600	...	150	68	1,200,000
Redwood.....	600	640	125	56	1,200,000
Spruce, Red, White, Sitka.....	600	640	125	68	1,200,000
Englemann.....	370	...	100	56	800,000
Tamarack, Eastern.....	680	...	200	76	1,300,000

**WORKING STRESSES IN POUNDS PER SQUARE INCH FOR JOISTS, PLANK
BEAMS AND STRINGERS—CONTINUED.**

OCCASIONALLY WET BUT QUICKLY DRIED.

Select Grade.

SPECIES	EXTREME FIBER IN BENDING		COMPRESSION PERPENDICULAR TO GRAIN	MAXIMUM HORIZONTAL SHEAR	MODULUS OF ELASTICITY
	4" and Thinner	5" and Thicker			
Cedar, Western Red.....	710	800	150	80	1,000,000
Northern and Southern White.....	580	...	140	70	800,000
Port Orford.....	890	1000	200	90	1,200,000
Alaska.....	890	...	200	90	1,200,000
Cypress, Southern.....	980	...	250	100	1,200,000
Douglas Fir, Coast Region: Select.....	1240	1385	240	90	1,600,000
Dense Select.....	1370	1515	265	105	1,600,000
Rocky Mountain Region.....	800	900	225	85	1,200,000
Fir, Balsam.....	670	...	125	70	1,000,000
Golden, Noble, Silver, White.....	800	...	225	70	1,100,000
Hemlock, West Coast.....	980	1100	225	75	1,400,000
Eastern.....	800	...	225	70	1,100,000
Larch, Western.....	980	1100	225	100	1,300,000
Pine, Southern: Select.....	1240	1385	240	110	1,600,000
Dense Select.....	1370	1515	265	128	1,600,000
California, Idaho and Northern White					
Pondosa and Sugar.....	710	...	150	85	1,000,000
Norway.....	890	...	175	85	1,200,000
Redwood.....	890	1000	150	70	1,200,000
Spruce, Red, White, Sitka.....	800	900	150	85	1,200,000
Englemann.....	580	...	140	70	800,000
Tamarack, Eastern.....	980	...	225	95	1,300,000

Common Grade.

Cedar, Western Red.....	600	640	150	64	1,000,000
Northern and Southern White.....	490	...	140	56	800,000
Port Orford.....	760	800	200	72	1,200,000
Alaska.....	760	...	200	72	1,200,000
Cypress, Southern.....	830	...	250	80	1,200,000
Douglas Fir, Coast Region.....	980	1040	225	72	1,600,000
Rocky Mountain Region.....	680	720	225	68	1,200,000
Fir, Balsam.....	570	...	125	56	1,000,000
Golden, Noble, Silver, White.....	680	...	225	56	1,100,000
Hemlock, West Coast.....	830	880	225	60	1,400,000
Eastern.....	680	...	225	56	1,100,000
Larch, Western.....	830	880	225	80	1,300,000
Pine, Southern.....	980	1040	225	88	1,600,000
California, Idaho and Northern White					
Pondosa and Sugar.....	600	...	150	68	1,000,000
Norway.....	760	...	175	68	1,200,000
Redwood.....	760	800	150	56	1,200,000
Spruce, Red, White, Sitka.....	680	720	150	68	1,200,000
Englemann.....	490	...	140	56	800,000
Tamarack, Eastern.....	830	...	225	76	1,300,000

BUILDING CODE REQUIREMENTS FOR LIVE LOAD IN VARIOUS CITIES

In Pounds Per Square Foot

STRUCTURE	BALTIMORE	BOSTON	BUFFALO	CHICAGO	CINCINNATI	INDIANAPOLIS	MILWAUKEE	MINNEAPOLIS	NEW ORLEANS	NEW YORK	PHILADELPHIA	PITTSBURGH	ST. LOUIS	SAN FRANCISCO	SEATTLE	WASHINGTON
Apartments	60	50	50	40	40	50	30	50	40	40	40	70	50	60	40	40
Assembly Halls	125	100	100	100	100	125	80	125	125	100	100	150	100	125	100	100
Dwellings	60	50	40	40	40	50	30	50	40	40	40	70	50	60	40	40
Hospitals	75	50	70	50	40	50	30	50	70	40	40	70	50	40	40	40
Hotels	60	50	70	50	40	75	30	50	70	40	40	70	50	60	40	40
Heavy Manufacturing	175	250	120	100	150	200	100	...	200	120	120	125	...	250	125	150
Light Manufacturing	125	125	120	100	100	100	100	100	125	120	120	125	100	125	...	150
Heavy Warehouse	250	250	150	100	150	200	100	...	200	120	120	200	150	250	...	250
Offices	75	75	50	50	50	75	40	75	70	60	60	70	60	40	50	70
Schools—Class Rooms	50	50	50	40	60	100	40	75	60	75	75	75	75	75	50	40
Roofs—Slope less than 20°	30	40	40	25	25	30	30	50	30	40	30	50	30	30	40	30

Metric Tables.

	Approximate Equivalent.	Accurate Equivalent.
1 inch	[length]... 2 1/2	cubic centimeters 2.539
1 centimeter	0.4	inch 0.393
1 yard	1	meter 0.914
1 meter (39.37 inches)	1	yard 1.093
1 foot	30	centimeters 30.479
1 kilometer (1,000 meters)	5 1/8	mile 0.621
1 mile	1 1/2	kilometers 1.600
1 gramme	[weight]... 15 1/2	grains 15.432
1 grain	0.064	gramme 0.064
1 kilogramme (1,000 grammes)	2.2	pounds avoirdupois 2.204
1 pound avoirdupois	1/2	kilogramme 0.453
1 ounce avoirdupois (437 1/2 grains)	28 1/3	grammes 28.349
1 ounce troy, or apothecary (480 grains)	31	grammes 31.103
1 cubic centimeter	[bulk]... 1.06	cubic inch 1.060
1 cubic inch	16 1/3	cubic centimeters 16.386
1 liter (1,000 cubic centimeters)	1	U. S. standard quart 0.946
1 United States quart	1	liter 1.057
1 fluid ounce	29 1/2	cubic centimeters 29.570
1 hectare (10,000 square meters)	[surface]... 2 1/2	acres 2.471
1 acre	0.4	hectare 0.40

In the nickel five-cent piece of our coinage is a key to the tables of linear measures and weights. The diameter of this coin is two centimeters, and its weight is five grammes. Five of them placed in a row will give the length of the decimeter, and two of them will weigh a decagram. As the kiloliter is a cubic meter, the key to the measure of length is also the key to the measure of capacity.

Handy Table.

Diameter of a circle $\times 3.1416$ = circumference.	Circumference of a sphere \times its diameter = surface.
Radius of a circle $\times 6.283185$ = circumference.	Square of the diameter of a sphere $\times 3.1416$ = surface.
Square of the diameter of a circle $\times 0.7854$ = area.	Square of the circumference of a sphere $\times 0.3183$ = surface.
Square of the circumference of a circle $\times 0.07958$ = area.	Cube of the diameter of a sphere $\times 0.5236$ = solidity.
Half the circumference of a circle \times half its diameter = area.	Cube of the radius of a sphere $\times 4.1888$ = solidity.
Circumference of a circle $\times 0.159155$ = radius.	Cube of the circumference of a sphere $\times 0.016887$ = solidity.
Square root of the area of a circle $\times 0.56419$ = radius.	Square root of the surface of a sphere $\times 0.56419$ = diameter.
Circumference of a circle $\times 0.31831$ = diameter.	Square root of the surface of a sphere $\times 1.772454$ = circumference.
Square root of the area of a circle $\times 1.12838$ = diameter.	Cube root of the solidity of a sphere $\times 1.2407$ = diameter.
Diameter of a circle $\times 0.86$ = side of inscribed equilateral triangle.	Cube root of the solidity of a sphere $\times 3.8978$ = circumference.
Diameter of a circle $\times 0.7071$ = side of an inscribed square.	Radius of a sphere $\times 1.1547$ = side of inscribed cube.
Circumference of a circle $\times 0.225$ = side of an inscribed square.	Square root of (1/4 of the square of) the diameter of a sphere = side of inscribed cube.
Circumference of a circle $\times 0.282$ = side of an equal square.	Area of its base $\times 1/4$ of its altitude = solidity of a cone or pyramid, whether round, square, or triangular.
Diameter of a circle $\times 0.8862$ = side of an equal square.	Area of one of its sides $\times 6$ = surface of a cube.
Base of a triangle $\times 1/2$ the altitude = area.	Altitude of trapezoid $\times 1/2$ the sum of its parallel sides = area
Multiplying both diameters and .7854 together = area of an ellipse.	
Surface of a sphere $\times 1/6$ of its diameter = solidity.	

Square root of ($\frac{1}{3}$ of the square of) the diameter of a sphere = side of inscribed cube.

Area of its base $\times \frac{1}{3}$ of its altitude = solidity of a cone or pyramid, whether round, square, or triangular.

Area of one of its sides $\times 6$ = surface of a cube.

Altitude of trapezoid $\times \frac{1}{2}$ the sum of its parallel sides = area.

TABLE OF SQUARE ROOTS.

No.	Sq. Root.	No.	Sq. Root.	No.	Sq. Root.	No.	Sq. Root.
25	5.	650	25.46	1400	37.42	2600	50.99
50	7.071	700	26.46	1450	38.08	2700	51.96
75	8.66	750	27.39	1500	38.73	2800	52.91
100	10.00	800	28.28	1550	39.37	2900	53.85
125	11.18	850	29.15	1600	40.00	3000	54.77
150	12.25	900	30.00	1650	40.62	3200	56.57
175	13.23	950	30.82	1700	41.23	3400	58.30
200	14.14	1000	31.62	1800	42.43	3600	60.00
250	15.81	1050	32.40	1900	43.59	3800	61.64
300	17.32	1100	33.16	2000	44.72	4000	63.24
350	18.70	1150	33.91	2100	45.82	4200	64.80
400	20.00	1200	34.64	2200	46.90	4400	66.32
450	21.21	1250	35.36	2300	47.95	4600	67.82
500	22.36	1300	36.06	2400	48.99	4800	69.28
550	23.45	1350	36.74	2500	50.00	5000	70.72
600	24.49						

Expansion of Water (Dalton).

Temperature.	Expansion.	Temperature.	Expansion.	Temperature.	Expansion.
22°	1.0009	72°	1.0018	152°	1.01934
32	1	92	1.00477	172	1.02575
*46	1	112	1.0088	192	1.03265
52	1.00021	132	1.01367	212	1.0466

*Greatest density at 39.1° Fahr.

Capacity of Bins and Boxes.

A box 24 inches long by 16 inches wide and 28 inches deep will contain a barrel, or three bushels; 24 by 16 inches and 14 inches deep contains half a barrel; 16 inches square and 8 $\frac{1}{2}$ inches deep will contain one bushel; 16 by 8 $\frac{1}{2}$ inches and 8 inches deep will contain half a bushel; 8 by 8 $\frac{1}{2}$ inches and 8 inches deep will contain one peck; 8 inches square and 4 $\frac{1}{2}$ inches deep will contain one gallon; 7 by 4 inches and 4 $\frac{1}{2}$ inches deep will contain half a gallon; 4 inches square and 4 $\frac{1}{2}$ inches deep will contain one quart; 4 feet long, 3 feet 5 inches wide and 2 feet 8 inches deep will contain one ton of coal, or 36 cubic feet.

Dimensions of a Barrel.—Diameter of head, 17 inches; bung, 19 inches; length, 28 inches; volume, 7,680 cubic inches.

Table Showing the Pressure of Water at Different Elevations.

Feet Head	Equals Pressure per Square Inch	Feet Head	Equals Pressure per Square Inch	Feet Head	Equals Pressure per Square Inch	Feet Head	Equals Pressure per Square Inch	Feet Head	Equals Pressure per Square Inch	Feet Head	Equals Pressure per Square Inch
1	43	65	28.15	130	56.31	195	84.47	260	112.62	350	151.61
5	2 16	70	30.32	135	58.48	200	86.63	265	114.79	360	155.94
10	4 33	75	32.48	140	60.64	205	88.80	270	116.96	370	160.27
15	6 49	80	34.65	145	62.81	210	90.96	275	119.12	380	164.61
20	8 66	85	36.82	150	64.97	215	93.14	280	121.29	390	168.94
25	10 82	90	38.98	155	67.14	220	95.30	285	123.45	400	173.27
30	12 99	95	41.15	160	69.31	225	97.49	290	125.62	500	216.58
35	15 16	100	43.31	165	71.47	230	99.63	295	127.78	600	259.90
40	17 32	105	45.48	170	73.64	235	101.79	300	129.95	700	303.22
45	19 49	110	47.64	175	75.80	240	103.96	310	134.28	800	346.44
50	21 65	115	49.81	180	77.97	245	106.13	320	138.62	900	389.86
55	23 82	120	51.98	185	80.14	250	108.29	330	142.95	1,000	433.18
60	25 99	125	54.15	190	82.30	255	110.46	340	147.28		

For an exhaustive discussion of live loads in buildings send for "Report of Building Code Committee," Nov. 1, 1924, U. S. Dept. of Commerce entitled "Minimum Live Loads Allowable for Use in Design of Buildings." This report gives tables tabulating almost every kind of building occupancy.

Weights of Materials. Dry Woods.

	Lbs. Board ft.	Lbs. Cubic ft.		Lbs. Board ft.	Lbs. Cubic ft.
Apple	4.1	49.	Iron Wood	6.	71.
Ash, American white	3.9	47.	Larch	3.	35.
Birch	3.9	45.	Lignum Vitæ	6.9	83.
Beech	3.7	43.	Mahogany, Honduras	2.9	35.
Boxwood	5.	60.	Mahogany, Spanish	4.4	53.
Cedar, American	2.9	35.	Maple	4.1	49.
Cedar, W. Indian	3.9	47.	Maple, soft	3.5	42.
Cedar, Lebanon	2.5	30.	Oak, live	4.9	59.3
Cherry	3.5	42.	Oak, red	3.9	45.
Chestnut	3.4	41.	Oak, white	4.3	52.
Cork	1.3	15.	Pine, Southern	3.7	45.
Elm	2.9	35.	Pine, white	2.1	25.
Ebony	6.3	76.1	Pine, yellow	2.8	34.3
Hemlock	2.1	25.	Spruce	2.1	25.
Hickory	4.4	53.	Sycamore	3.1	37.
Hornbeam	2.9	47.	Walnut	3.2	38.

Building Materials—Stacked.

	Lbs. per cubic ft.		Lbs. per cubic ft.
Brick—pressed	150	Glass—window	157
“ common	125	Granite	170
“ soft	100	Lime—quick	53
Cement—Portland	100	Plaster of Paris	70
Cement—Rosedale	56	Sand	90-106
Cinders—dry	72	Sandstone	151
Cinders—packed	90	Shale	162
Earth—dry, shaken	82- 92	Slate	175
Earth—rammed	92-100	Trap rock	187

Masonry.

	Lbs. per cubic ft.		Lbs. per cubic ft.
Brick—pressed or paving	140	Granite	160
Brick—hard, common	120	Mortar and plaster	120
Brick—soft	100	Rubble—limestone, common	140
Brick—hollow	90	Rubble—limestone, cut face	150
Concrete—stone	150	Rubble—sandstone, common	140
Concrete—cinder	96	Rubble—sandstone, cut face	150

Standard Load-Bearing Wall Tile.

End construction:	Number of cells	Weight, each lbs.	Side construction:	Number of cells	Weight, each lbs.
3¾ by 12 by 12	3	20	3¾ by 5 by 12	1	9
6 by 12 by 12	6	30	8 by 5 by 12	2	16
8 by 12 by 12	6	36	8 by 5 by 12 (“L” shaped)	1	16
10 by 12 by 12	6	42	8 by 6¾ by 12 (“T” shaped)	4	16
12 by 12 by 12	6	48	8 by 7¾ by 12 (square)	6	24
			8 by 10¾ by 12 (“H” shaped)	7	32

Standard Partition Tile.

	Number of cells	Weight, each lbs.		Number of cells	Weight, each lbs.
3 by 12 by 12	3	15	8 by 12 by 12	4	30
4 by 12 by 12	3	16	10 by 12 by 12	4	36
6 by 12 by 12	3	22	12 by 12 by 12	4	40

Standard Split Furring Tile.

	Number of cells	Weight, each lbs.
2 by 12 by 12	9	

Standard Book Tile.

	Lbs. per sq. ft.
3 by 12 by 18 to 24	18

Building Materials—In Construction.

Roofing.

	Lbs. per square ft.		Lbs. per square ft.
Copper—sheet	0.75 to 1.25	Shingles—wood 16"	2
Felt and gravel	8 to 10	Singles—wood 16"	2
Iron—corrugated	1 to 3.75	Slate—average	10
Iron—galvanized	1 to 3	Tile—fancy, laid in mortar	25 to 30
Iron—sheet, black, painted	1.5	Tile—plain, average	12
Ready composition roofing	1 to 1.5	Tin and paint	1
Sheet lead	4 to 8	Zinc	1 to 2

Floors.

	Lbs. per sq. ft.		Lbs. per sq. ft.
Flat arches (tile) 3" thick	17	Flat arches (tile) 12" thick	39
“ “ “ 4" “	18	“ “ “ 14" “	43
“ “ “ 6" “	25	“ “ “ 16" “	49
“ “ “ 8" “	31	Book tile 2" thick	15
“ “ “ 10" “	35	“ “ 3" “	17
Brick arches 4" thick and concrete	70	Beam tile	15

Table for Weights of Yellow Pine Joists, Studs and Rafters on the Assumption That One Board Foot of Y. P. Weighs 2.8 Pounds.

Spacing	Size	Weight per Sq. Foot	Size	Weight Per Sq. Foot	Size	Weight
12"	2"x4"	1.87	2"x6"	2.8	2"x8"	3.74
14"	"	1.60	"	2.4	"	3.20
16"	"	1.40	"	2.1	"	2.80
18"	"	1.25	"	1.87	"	2.50
20"	"	1.12	"	1.68	"	2.24
22"	"	1.02	"	1.53	"	2.04
12"	2"x10"	4.68	2"x12"	5.61	2"x14"	6.55
14"	"	4.00	"	4.80	"	5.60
16"	"	3.50	"	4.20	"	4.90
18"	"	3.13	"	3.75	"	4.38
20"	"	2.80	"	3.36	"	3.92
22"	"	2.55	"	3.06	"	3.57

Partitions.

	Lbs. per sq. ft.		Lbs. per sq. ft.
Gypsum partition blocks 3" thick....	10	Partition tile 3" thick.....	17
" " " 4" ".....	12	" " 4" ".....	18
" " " 5" ".....	14	" " 6" ".....	25
" " " 6" ".....	16	" " 8" ".....	31
Plaster on brick, tile or concrete...	5	" " 10" ".....	35

Ceiling.

	Lbs. per sq. ft.
Lath and plaster 2 coats.....	9
Lath and plaster 3 coats.....	10
Suspended ceiling	10

Sheathing, Flooring, etc.

	Lbs. per sq. ft.
Pine, Hemlock, Spruce, Poplar, Red-wood, per inch thick.....	3
Chestnut, Maple	4

Weight per Square Foot of Sheet Lead.

1/62 inch thick.....	2 lbs.	1/10 inch thick.....	7 lbs.
3/64 " ".....	2 1/2 "	1/8 " ".....	8 "
1/25 " ".....	3 "	5/32 " ".....	10 "
1/16 " ".....	4 "	3/16 " ".....	12 "
1/14 " ".....	5 "	7/32 " ".....	14 "
1/12 " ".....	6 "	1/4 " ".....	16 "

Miscellaneous Items.

	Lbs. per sq. ft.
While the following items vary considerably in weight, the values given below are fair averages and may be used for preliminary computations.	
Iron stair construction	50
Concrete stair construction	150
Wood stair construction	20
Sidewalk lights in concrete.....	30
Reinforcement of concrete	6
Steel joists per sq. ft. of floor....	6
Steel girders per sq. ft. of floor....	4

Contents of Storage Warehouses.


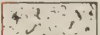
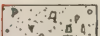
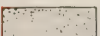
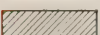
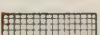
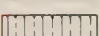
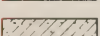
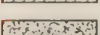
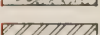
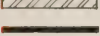

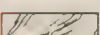

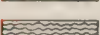
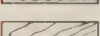

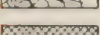
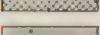
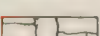
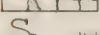
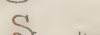
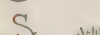
Material.	Weight Allowable per Cu. ft.	Height of Pile in ft.	Weight Allowable per Cu. ft.	Height of Pile in ft.
Groceries Etc.				
Beans—in bags	40	8	Wool—worsted, in cases..	27 8
Canned goods—cases	58	6	Hardware, Etc.	
Coffee—roasted, in bags....	33	8	Sheet tin—in boxes.....	278 2
Coffee—green, in bags.....	39	8	Wire—insulated copper, in coils	63 5
Flour—in barrels	40	5	Wire—galvanized iron, in coils	74 4.5
Molasses—in barrels.....	48	5	Wire—magnet, on spools..	75 6
Rice—in bags	58	6	Drugs, Paints, Oils, Etc.	
Salt Soda—in barrels.....	46	5	Glycerine—in cases.....	52 6
Salt—in bags	70	5	Linseed oil—in bbls.....	36 6
Soap powder—in cases.....	38	8	Logwood extract—in boxes	70 5
Starch—in barrels	25	6	Rosin—in bbls.....	48 6
Sugar—in barrels	43	5	Shellac—gum	38 6
Sugar—in cases	51	6	Soda — Caustic, in iron drums	88 3.33
Tea—in chests	25	8	Soda—Silicate, in bbls....	53 6
Wines and Liquors, in bbls.	38	6	Sulphuric Acid	60 1.66
Dry Goods, Cotton, Wool, Etc.			White Lead Paste—in cans	174 3.5
Burlap—in bales	43	6	White Lead—dry	86 4.75
Coir Yarn, in bales.....	33	8	Red Lead and Litharge	
Cotton — in bales, compressed	18	8	Putty—dry	132 3.75
Cotton Bleached Goods — in cases	28	8	Miscellaneous.	
Cotton Flannel—in cases..	12	8	Glass and Chinaware — in cases	40 8
Cotton Sheeting—in cases.	23	8	Hides and Leather — in bales	20 8
Cotton Yarn—in cases....	25	8	Paper — newspaper and strawboard	35 6
Excelsior—compressed ..	19	8	Paper—writing and calendared	60 6
Hemp—Manila, compressed	30	8	Rope—in coils	32 6
Linen Goods—in cases....	30	8		
Wool—in bales, not compressed	13	8		





NOMENCLATURE OF DRAWINGS

We present in the following pages a collation of symbols for plan nomenclature, which we hope will be the means of bringing about a more uniform practice. In addition to the convenience, which will result from uniform practice to those compelled to examine, estimate from or execute plans from different offices; it will be found that the proficiency of draftsmen will not be so seriously affected on changing from office to office if practice becomes uniform.

General symbols presented have been collated from various sources. To assist memory those symbols have been selected which are suggestive in their make up.

GENERAL SYMBOLS






	In color system use
	Earth Black
	Cinders Green
	Concrete Brown
	Stone Blue
	Brick Red
	Structural tile..... Brown
	Composition wall blocks..... Blue
	Architectural terra cotta Brown
	Plaster Blue
	Structural iron..... Green
	Sheet metal..... Green
	Floor tile, tile and mosaics..... Brown
	Marble (in elevation)..... Blue
	Marble (in section)..... Blue
	Terrazzo Black
	Wood in section (soft wood) Yellow with grain. (hard wood) Brown
	Wood in section (soft wood) Yellow across grain. (hard wood) Brown
	Cork Brown
	Glass Blue
	Rubble
	Rubble stone
	Dimensioned stone
	Ashlar stone

	Dressed ashlar
	Rock faced ashlar
	Any stone dressed
	Not described small numeral refers to details and specifications

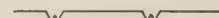

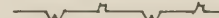

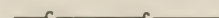
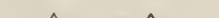

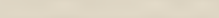
For illustration all lines indicating water pipes have a periodic double indentation suggestive of a "w"; gas lines a periodic embryo "G", etc.

Lighting symbols are those adopted by the American Institute of Architects and the National Electrical Contractors' Association, except that 50 watts is taken as the standard for one light unit instead of 16 c. p.


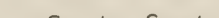
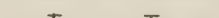
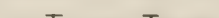
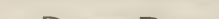
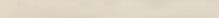
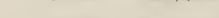
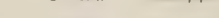
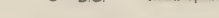
Structural iron standard symbols; the Osborn systems are so generally understood and used that it hardly seems necessary to publish same. (See Cambria pocket book, 1906 edition, p. 309.)






	Column: Small numeral indicates No. of particular column
	Door: Small numeral indicates No. of particular door
	Window: Small numeral indicates No. of particular window
	Indicates designating No. of a room or space.
	Elevation of point; small numerals indicate elevation above zero point.

PIPING SYMBOLS

	In color system
	Cold water..... Blue
	Hot water..... Red
	Hot water return..... Red
	Filtered or drinking water..... Blue
	Gas piping..... Green
	Air piping..... Green
	Compressed air piping Green
	Vacuum cleaning Green

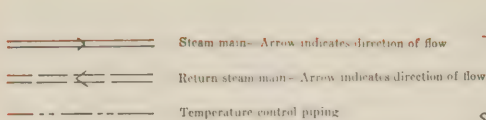
SEWERAGE AND DRAINAGE

	Iron sewer pipe Green
	Sanitary iron sewer pipe..... Green
	Tile sewer..... Red
	Sanitary Tile Sewer..... Red
	Drainage tile..... Brown
	Soil pipe Green
	Waste pipe Green
	Down spout Green
	Vent riser Green

	Floor drain..... Brown
	Bracket. Prefix with "F" if for fuel Blue
	Ceiling. Prefix with "F" if for fuel Blue
	Floor outlet. Prefix with "F" if for fuel Blue
	Combined gas and electric, lower figure indicates No. of gas tips, upper figure indicates No. of 50 watt electric lamps Blue

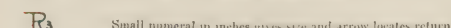
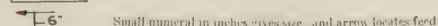
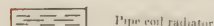
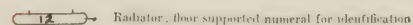
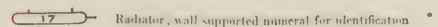
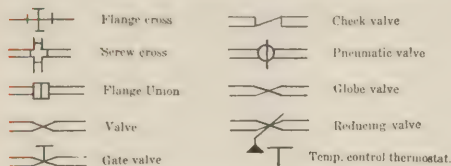
STANDARD SYMBOLS FOR WIRING PLANS

	Ceiling Outlet	As recommended and adopted by The Association of Electragists, International, The American Institute of Architects, and the American Institute of Electrical Engineers and approved by The American Engineering Standards Committee on March 6, 1924.		Telephone Cabinet
	Ceiling Outlet (Gas and Electric)			Telegraph Cabinet
	Ceiling Lamp Receptacle <small>Specification to Describe Type Such as Key, Keyless or Pull Chain</small>			Special Outlet for Signal System <small>As described in specification</small>
	Ceiling Outlet for Extensions			Battery
	Ceiling Fan Outlet			Tank Switch
	Pull Switch			Motor
	Drop Cord			Motor Controller
	Wall Bracket			Lighting Panel
	Wall Bracket (Gas and Electric)			Power Panel
	Wall Outlet for Extensions			Heating Panel
	Wall Fan Outlet			Pull Box
	Wall Lamp Receptacle <small>Specification to Describe Type Such as Key, Keyless or Pull Chain</small>			Cable Supporting Box
	Single Convenience Outlet			Meter
	Double Convenience Outlet			Transformer
	Junction Box			Branch Circuit, Run Concealed Under Floor Above
	Special Purpose Outlet <small>Lighting, Heating and Power as Described in Specification</small>			Branch Circuit, Run Exposed
	Special Purpose Outlet <small>Lighting, Heating and Power as Described in Specification</small>			Branch Circuit, Run Concealed Under Floor
	Special Purpose Outlet <small>Lighting, Heating and Power as Described in Specification</small>			Signal Wires in Conduit Concealed Under Floor
	Exit Light			Signal Wires in Conduit Concealed Under Floor Above
	Floor Outlet			Tap Circuits Indicated by 2 Number 14 Conductors in 1/2 inch Conduit
	Floor Elbow			3 Number 14 Conductors in 1/2 inch Conduit
	Floor Tee			4 Number 14 Conductors in 3/4 inch Conduit Unless Marked 1/2 inch
	Local Switch—Single Pole			5 Number 14 Conductors in 1 inch Conduit
	Local Switch—Double Pole			6 Number 14 Conductors in 1 inch Conduit Unless Marked 3/4 inch
	Local Switch—3 Way			7 Number 14 Conductors in 1 inch Conduit
	Local Switch—4 Way			8 Number 14 Conductors in 1 inch Conduit
	Automatic Door Switch			Feeder Run Concealed Under Floor Above
	Key Push Button Switch			Feeder Run Exposed
	Electrolier Switch			Feeder Run Concealed Under Floor
	Push Button Switch and Pilot			Pole Line

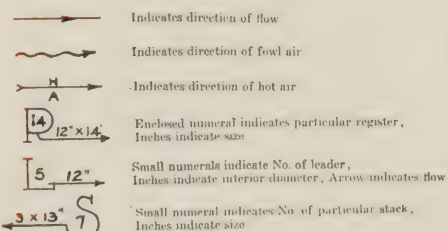


● S F 7 Steam feed vertical—No. designates particular pipe

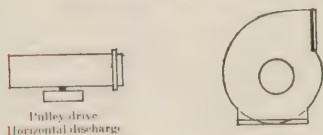
● S R 5 Steam return vertical—No. designates particular pipe



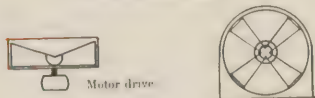
VENTILATING SYMBOLS



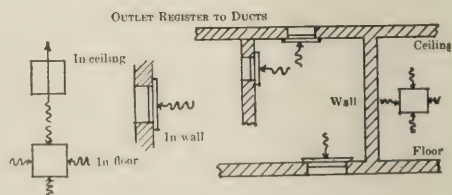
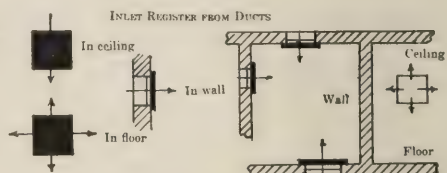
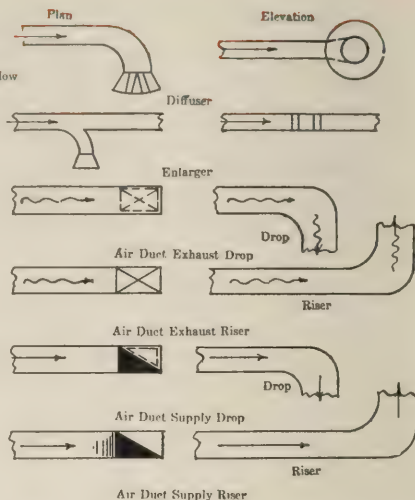
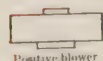
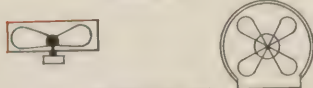
MECHANICAL EQUIPMENT



CENTRIFUGAL FAN



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MECHANICAL EQUIPMENT

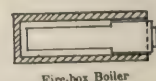
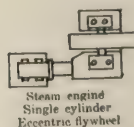
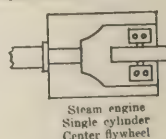
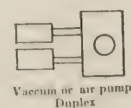
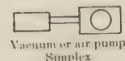
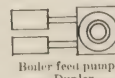
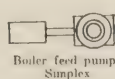
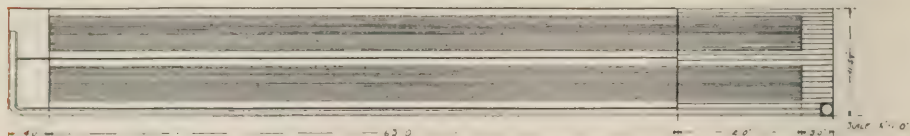
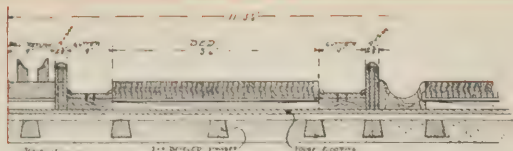


TABLE OF TREADS AND RISERS.

No. of Risers.	6	6 ¹ / ₂	7	7 ¹ / ₂	7 ³ / ₄	7 ¹ / ₂	7 ³ / ₄	7 ¹ / ₂	7 ³ / ₄	8	8 ¹ / ₂	9	9 ¹ / ₂	10	10 ¹ / ₂	11	11 ¹ / ₂	12	12 ¹ / ₂	13	13 ¹ / ₂	14
Inch Rise, ft. in.	6 ¹ / ₂	6 ¹ / ₂	7	7 ¹ / ₂	7 ³ / ₄	7 ¹ / ₂	7 ³ / ₄	7 ¹ / ₂	7 ³ / ₄	8	8 ¹ / ₂	9	9 ¹ / ₂	10	10 ¹ / ₂	11	11 ¹ / ₂	12	12 ¹ / ₂	13	13 ¹ / ₂	14
1	6	6 ¹ / ₂	7	7 ¹ / ₂	7 ³ / ₄	7 ¹ / ₂	7 ³ / ₄	7 ¹ / ₂	7 ³ / ₄	8	8 ¹ / ₂	9	9 ¹ / ₂	10	10 ¹ / ₂	11	11 ¹ / ₂	12	12 ¹ / ₂	13	13 ¹ / ₂	14
2	1 0	1 0 ¹ / ₂	1 2	1 2 ¹ / ₂	1 2 ³ / ₄	1 3	1 3 ¹ / ₂	1 3 ³ / ₄	1 3 ¹ / ₂	1 4	1 4 ¹ / ₂	1 6	1 6 ¹ / ₂	1 8	1 8 ¹ / ₂	1 10	1 10 ¹ / ₂	12	12 ¹ / ₂	13	13 ¹ / ₂	14
3	1 6	1 6 ¹ / ₂	1 9	1 9 ¹ / ₂	1 9 ³ / ₄	1 10 ¹ / ₂	1 10 ³ / ₄	1 10 ¹ / ₂	1 10 ³ / ₄	2 0	2 0 ¹ / ₂	2 3	2 3 ¹ / ₂	2 6	2 6 ¹ / ₂	2 9	2 9 ¹ / ₂	14	14 ¹ / ₂	15	15 ¹ / ₂	16
4	2 0	2 1	2 4	2 4 ¹ / ₂	2 5	2 5 ¹ / ₂	2 5 ³ / ₄	2 6	2 6 ¹ / ₂	2 8	2 8 ¹ / ₂	3 0	3 0 ¹ / ₂	3 4	3 4 ¹ / ₂	3 8	3 8 ¹ / ₂	16	16 ¹ / ₂	17	17 ¹ / ₂	18
5	2 6	2 7 ¹ / ₂	2 11	2 11 ¹ / ₂	3 0 ¹ / ₂	3 0 ³ / ₄	3 1	3 1 ¹ / ₂	3 1 ³ / ₄	3 4	3 4 ¹ / ₂	3 9	3 9 ¹ / ₂	4 2	4 2 ¹ / ₂	4 7	4 7 ¹ / ₂	18	18 ¹ / ₂	19	19 ¹ / ₂	20
6	3 0	3 1 ¹ / ₂	3 6	3 6 ¹ / ₂	3 7 ¹ / ₂	3 8	3 8 ¹ / ₂	3 9	3 9 ¹ / ₂	4 0	4 1 ¹ / ₂	4 6	4 6 ¹ / ₂	5 0	5 0 ¹ / ₂	5 6	5 6 ¹ / ₂	20	20 ¹ / ₂	21	21 ¹ / ₂	22
7	3 6	3 7 ¹ / ₂	4 1	4 1 ¹ / ₂	4 2 ¹ / ₂	4 3 ¹ / ₂	4 4	4 4 ¹ / ₂	4 5 ¹ / ₂	4 8	4 8 ¹ / ₂	5 3	5 3 ¹ / ₂	5 10	5 10 ¹ / ₂	6 5	6 5 ¹ / ₂	22	22 ¹ / ₂	23	23 ¹ / ₂	24
8	4 0	4 2	4 8	4 8 ¹ / ₂	4 10	4 11	5 0	5 1	5 2	5 4	5 6	6 0	6 0 ¹ / ₂	6 8	6 8 ¹ / ₂	7 4	7 4 ¹ / ₂	24	24 ¹ / ₂	25	25 ¹ / ₂	26
9	4 6	4 8 ¹ / ₂	5 3	5 4 ¹ / ₂	5 5 ¹ / ₂	5 6 ¹ / ₂	5 8 ¹ / ₂	5 9 ¹ / ₂	5 10 ¹ / ₂	6 0	6 2 ¹ / ₂	6 9	7 1 ¹ / ₂	7 6	7 7 ¹ / ₂	8 3	8 3 ¹ / ₂	26	26 ¹ / ₂	27	27 ¹ / ₂	28
10	5 0	5 2 ¹ / ₂	5 10	5 11 ¹ / ₂	5 12 ¹ / ₂	5 13 ¹ / ₂	5 16 ¹ / ₂	5 17 ¹ / ₂	5 18 ¹ / ₂	6 8	6 10 ¹ / ₂	7 1	7 6	8 4	8 5 ¹ / ₂	9 2	9 2 ¹ / ₂	28	28 ¹ / ₂	29	29 ¹ / ₂	30
11	5 6	5 8 ¹ / ₂	6 5	6 6 ¹ / ₂	6 7 ¹ / ₂	6 9 ¹ / ₂	6 11 ¹ / ₂	6 12 ¹ / ₂	6 13 ¹ / ₂	7 4	7 7 ¹ / ₂	8 3	8 3 ¹ / ₂	9 2	9 2 ¹ / ₂	10 1	10 1 ¹ / ₂	30	30 ¹ / ₂	31	31 ¹ / ₂	32
12	6 0	6 3	7 0	7 1 ¹ / ₂	7 3	7 4 ¹ / ₂	7 6 ¹ / ₂	7 7 ¹ / ₂	7 8 ¹ / ₂	8 0	8 3	9 0	9 0 ¹ / ₂	10 0	10 0 ¹ / ₂	11 0	11 0 ¹ / ₂	32	32 ¹ / ₂	33	33 ¹ / ₂	34
13	6 6	6 9 ¹ / ₂	7 3 ¹ / ₂	7 4 ¹ / ₂	7 5 ¹ / ₂	7 7 ¹ / ₂	7 9 ¹ / ₂	8 0 ¹ / ₂	8 1 ¹ / ₂	8 8	8 11 ¹ / ₂	9 9	9 9 ¹ / ₂	10 10	10 10 ¹ / ₂	11 11	11 11 ¹ / ₂	34	34 ¹ / ₂	35	35 ¹ / ₂	36
14	7 0	7 3 ¹ / ₂	8 2	8 3 ¹ / ₂	8 5 ¹ / ₂	8 7 ¹ / ₂	8 9 ¹ / ₂	9 0 ¹ / ₂	9 1 ¹ / ₂	9 4	9 7 ¹ / ₂	10 6	10 6 ¹ / ₂	11 8	11 8 ¹ / ₂	12 8	12 8 ¹ / ₂	36	36 ¹ / ₂	37	37 ¹ / ₂	38
15	7 6	7 9 ¹ / ₂	8 9	8 10 ¹ / ₂	9 0 ¹ / ₂	9 2 ¹ / ₂	9 4 ¹ / ₂	9 6 ¹ / ₂	9 8 ¹ / ₂	10 0	10 3 ¹ / ₂	11 3	11 3 ¹ / ₂	12 6	12 6 ¹ / ₂	13 1	13 1 ¹ / ₂	38	38 ¹ / ₂	39	39 ¹ / ₂	40
16	8 0	8 4	9 4	9 6	9 8	9 10	10 0	10 2	10 4	10 8	11 0	12 0	12 0 ¹ / ₂	13 4	13 4 ¹ / ₂	14 0	14 0 ¹ / ₂	40	40 ¹ / ₂	41	41 ¹ / ₂	42
17	8 6	8 10 ¹ / ₂	9 11	10 1 ¹ / ₂	10 3 ¹ / ₂	10 5 ¹ / ₂	10 7 ¹ / ₂	10 9 ¹ / ₂	10 11 ¹ / ₂	11 4	11 8 ¹ / ₂	12 9	12 9 ¹ / ₂	14 2	14 2 ¹ / ₂	15 0	15 0 ¹ / ₂	42	42 ¹ / ₂	43	43 ¹ / ₂	44
18	9 0	9 4 ¹ / ₂	10 6	10 8 ¹ / ₂	10 10 ¹ / ₂	11 0 ¹ / ₂	11 2 ¹ / ₂	11 4 ¹ / ₂	11 6 ¹ / ₂	12 0	12 4 ¹ / ₂	13 6	13 6 ¹ / ₂	15 0	15 0 ¹ / ₂	16 0	16 0 ¹ / ₂	44	44 ¹ / ₂	45	45 ¹ / ₂	46
19	9 6	9 10 ¹ / ₂	10 11	11 3 ¹ / ₂	11 5 ¹ / ₂	11 8 ¹ / ₂	11 10 ¹ / ₂	12 0 ¹ / ₂	12 2 ¹ / ₂	12 8	13 0 ¹ / ₂	14 3	15 0 ¹ / ₂	15 10	16 0 ¹ / ₂	17 0	17 0 ¹ / ₂	46	46 ¹ / ₂	47	47 ¹ / ₂	48
20	10 0	10 5	11 8	11 10 ¹ / ₂	12 1	12 3 ¹ / ₂	12 6	12 8 ¹ / ₂	12 11	13 4	13 6 ¹ / ₂	15 0	15 10	16 8	17 6	18 4	18 4 ¹ / ₂	48	48 ¹ / ₂	49	49 ¹ / ₂	50
21	10 6	10 11 ¹ / ₂	12 3	12 5 ¹ / ₂	12 8 ¹ / ₂	13 0 ¹ / ₂	13 3 ¹ / ₂	13 6 ¹ / ₂	13 9 ¹ / ₂	14 0	15 0	16 0	16 10	17 6	18 4	19 0	19 0 ¹ / ₂	50	50 ¹ / ₂	51	51 ¹ / ₂	52
22	11 0	11 5 ¹ / ₂	12 10	12 13 ¹ / ₂	13 0 ¹ / ₂	13 3 ¹ / ₂	13 6 ¹ / ₂	13 9 ¹ / ₂	14 2 ¹ / ₂	15 0	16 0	17 0	17 10	18 4	19 2	20 0	20 0 ¹ / ₂	52	52 ¹ / ₂	53	53 ¹ / ₂	54
23	11 6	11 11 ¹ / ₂	13 5	13 7 ¹ / ₂	13 10 ¹ / ₂	14 1 ¹ / ₂	14 4 ¹ / ₂	14 7 ¹ / ₂	14 10 ¹ / ₂	15 4	16 0	17 0	17 10	18 4	19 2	20 0	20 0 ¹ / ₂	54	54 ¹ / ₂	55	55 ¹ / ₂	56
24	12 0	12 6	14 0	14 3	14 6	14 9	15 0	15 3	15 6	16 0	17 0	18 0	18 10	19 2	20 0	21 0	21 0 ¹ / ₂	56	56 ¹ / ₂	57	57 ¹ / ₂	58
25	12 6	13 0 ¹ / ₂	14 7	14 10 ¹ / ₂	15 1 ¹ / ₂	15 4 ¹ / ₂	15 7 ¹ / ₂	15 10 ¹ / ₂	16 1 ¹ / ₂	16 8	17 2 ¹ / ₂	18 9	19 3 ¹ / ₂	20 10	21 0 ¹ / ₂	22 11	22 11 ¹ / ₂	58	58 ¹ / ₂	59	59 ¹ / ₂	60
26	13 0	13 6 ¹ / ₂	15 2	15 5 ¹ / ₂	15 8 ¹ / ₂	15 11 ¹ / ₂	16 0	16 3 ¹ / ₂	16 6 ¹ / ₂	17 0	18 0	19 0	19 10	20 6	21 4	22 9	22 9 ¹ / ₂	60	60 ¹ / ₂	61	61 ¹ / ₂	62
27	13 6	14 0 ¹ / ₂	16 0	16 3 ¹ / ₂	16 6 ¹ / ₂	16 9 ¹ / ₂	17 0	17 3 ¹ / ₂	17 6 ¹ / ₂	18 0	19 0	20 0	20 10	21 6	22 4	23 9	23 9 ¹ / ₂	62	62 ¹ / ₂	63	63 ¹ / ₂	64
28	14 0	14 7	17 0	17 3 ¹ / ₂	17 6 ¹ / ₂	17 9 ¹ / ₂	18 0	18 3 ¹ / ₂	18 6 ¹ / ₂	19 0	20 0	21 0	21 10	22 6	23 4	24 9	24 9 ¹ / ₂	64	64 ¹ / ₂	65	65 ¹ / ₂	66
29	14 6	15 1 ¹ / ₂	18 0	18 3 ¹ / ₂	18 6 ¹ / ₂	18 9 ¹ / ₂	19 0	19 3 ¹ / ₂	19 6 ¹ / ₂	20 0	21 0	22 0	22 10	23 6	24 4	25 9	25 9 ¹ / ₂	66	66 ¹ / ₂	67	67 ¹ / ₂	68
30	15 0	15 7 ¹ / ₂	19 0	19 3 ¹ / ₂	19 6 ¹ / ₂	19 9 ¹ / ₂	20 0	20 3 ¹ / ₂	20 6 ¹ / ₂	21 0	22 0	23 0	23 10	24 6	25 4	26 9	26 9 ¹ / ₂	68	68 ¹ / ₂	69	69 ¹ / ₂	70

RULE FOR CALCULATING PROPORTIONED WIDTH AND HEIGHT OF TREADS AND RISERS OF STAIRS.
 Subtract the width of tread from 25 in. and the result will be twice the height of the riser. Thus: if the tread is 10 in. wide, then the height of riser proportionate to a 10-inch tread. This is exclusive of nosings.



SPACE OCCUPIED BY AUTOMOBILES.

Touring Cars.

Length, 13 ft. 6 in. to 20 ft.

Height, 7 ft. 3 in.

Width, 6 ft. 0 in.

Smallest practical door, 8 ft. 0 in. high by 8 ft. 0 in. wide. Alley door should be not less than 11 ft. 4 in. and should be set not less than 22 ft. from opposite side.

Heavy Trucks.

Length, 15 ft. to 26 ft.

Width, 6 ft. 0 in.

Height, 10 ft. 0 in.

Width on floor between wheel pockets, 43 in. Length of wheel pocket, 34 in.

Smallest practical door, 9 ft. 0 in. wide by 11 ft. 0 in. high; for largest trucks, 13 ft. 6 in. high.

Doors to alley should not be less than 12 ft. wide and should be set not less than 28 ft. from opposite side of alley.

Moving Vans.

Length, 13 ft. to 16 ft. 3 in.

Width, 7 ft. to 8 ft. 2 in.

Height, 10 ft. to 12 ft.

Smallest practical door 10 ft. 0 in. wide by 13 ft. 6 in. high.

CLEARANCE UNDER OLD ELEVATED RAILWAY STRUCTURES AND TROLLEY WIRES, 12 FT. 0 IN.

Clearance required by the city for steam roads, 13 ft. 6 in.

Architects will be perfectly safe in making the maximum limit of door heights for any sort of vehicle 13 ft. 6 in., standard subway height, as no vehicle can be used commercially on the streets of Chicago that will not clear steam road viaducts. They might go around elevated viaducts, but they can not go around steam road viaducts and there is a probability that any future elevated viaducts would be raised to the city standard height of 13 ft. 6 in.

FURNITURE DIMENSIONS.

FILE 8275

Chairs—Height of seat, 18"; depth of seat, 19"; top of back, 38"; arms, 9" above seat.

Lounges—6' long, 30" wide.

Tables—Writing, height, 2'-5"; sideboards, height, 3'-0"; general height, 2'-6".

Note—The smallest size practical for knee holes, 2' high by 1'-8" wide.

Beds—Single, width, 3' to 4'; $\frac{3}{4}$ bed, width, 4'; double bed, width, 4'-6" to 5'-0", length 6'-6" to 6'-8"; standard double bed, 4'-6" x 6'-6"; footboards, 2'-6" to 3'-6" high; headboards, 5' to 6'-6".

Bureaus—Common, width, 3'-5" or 4'; depth, 1'-6" or 1'-8"; height, 2'-6" or 3'.

Commodore—Top, 1'-6" square and 2'-6" high.

Chiffoniers—3' wide, 1'-8" deep, 4'-4" high.

Cheval Glasses—Height, 6'-4" or 5'-0" or 5'-2"; width, 3'-2" or 2'-6" or 1'-8".

Washstands—Length, 3'-0"; width, 1'-6"; height, 2'-7".

Wardrobes—Length, 4'-6"—3'-0"; depth, 2'-0"—1'-5"; height, 8'-0".

Sideboards—Length, 5' to 6'; depth, 2'-2".

Pianos—Upright, length, 4'-10" to 5'-6"; height, 4'-4" to 4'-9"; depth, 2'-4". Square, length, 6'-8"; depth, 3'-4".

Billiard Tables—4'-8", 4½" x 9, 5' x 10.

Must have 16' x 20' space.

Wardrobe Shelves—5'-10" high.

Coat Hooks—5'-8" high.

Flour Barrel—28" to 30" high and 20" to 21" dia.

DATA ON BUILDINGS WITH SIDINGS.

Clearance from face of building to center of track, 7'-0".

Height of loading decks:

For shipping, 4'-0".

For receiving, 3'-0".

Clearance from center of track to edges of loading decks:

Upper edge, 7'-0".

Lower edge, 5'-0".

Spec. No.	No. of Stops.	From Back to Front Line of Case.	Width of Space Required.	Height Required for Swell-Box and Large Pipes.
5	10	7' 4"	11' 6"	12' 6"
7	11	8'	11' 6"	12' 6"
8	12	8'	12' 6"	12' 6"
10	13	8' 7"	12' 6"	12' 6"
11	14	9' 3"	12' 6"	12' 6"
13	16	10' 5"	12' 6"	12' 6"
14	17	11'	14' 8"	17'
16	18	11' 7"	14' 8"	17'
17	19	12' 2"	14' 8"	17'
19	20	12' 9"	14' 8"	17'

Spec. No.	No. of Stops.	From Back to Front Line of Case.	Width of Space Required.	Height Required for Swell-Box and Large Pipes.
20	21	12' 9"	15' 6"	17'
22	22	13' 4"	15' 6"	17'
23	23	13' 6"	15' 6"	17'
25	24	14'	15' 6"	17'
26	25	14' 6"	15' 6"	17'
28	26	14' 6"	15' 6"	17'
29	27	14' 6"	16' 4"	17' 6"
31	28	15'	16' 4"	17' 6"
32	29	15' 6"	16' 4"	17' 6"
34	30	15' 6"	17'	17' 6"

Add 40" more from Front Line of Case for Keydesk Pedals and Seat.

SIZES OF FREIGHT CARS AND LEGAL RAILWAY CLEARANCES

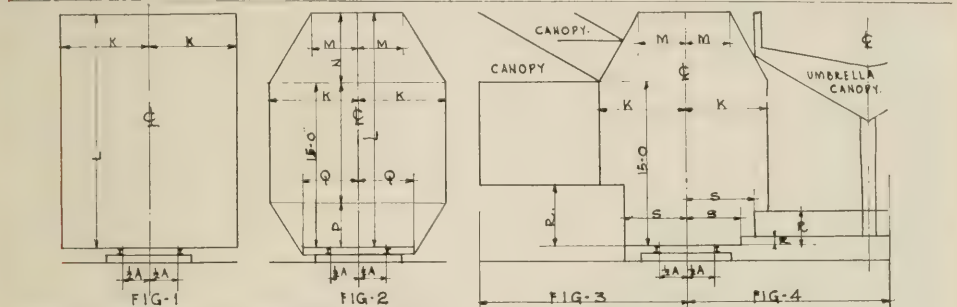
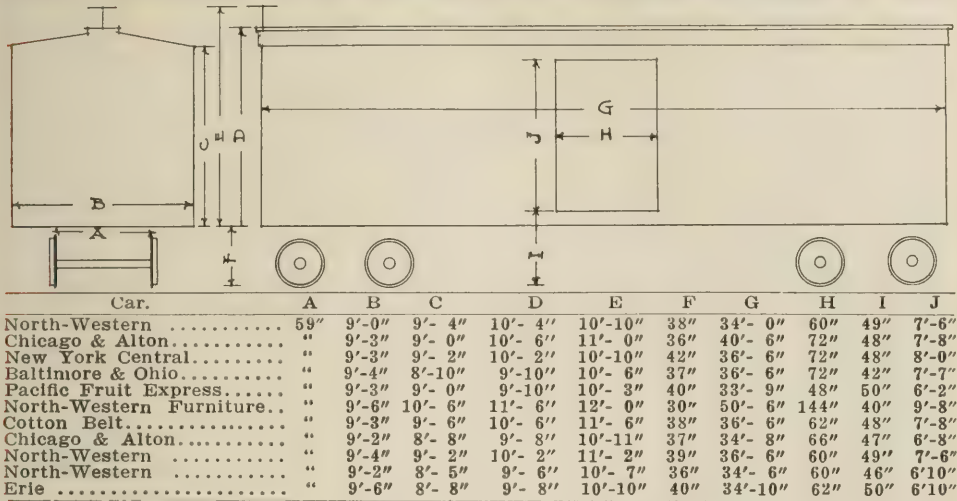


Fig. 1. Buildings and Miscellaneous Structures adjacent to Main Tracks, L=21' 6", K=8' 0"; Adjacent to Subsidiary Passenger Tracks L=21' 6", K=7' 6"; Tracks entering buildings L=car clearance (see diagram above for estimate), K=7' 0".
Structures adjacent to Subsidiary Freight Tracks except as otherwise specified. Tracks outside buildings L=21' 6", K=8' 0"; Tracks entering buildings L=practical car clearance, K=7' 0".
Fig. 2. Bridges supporting Main Tracks or Subsidiary Freight Tracks clearance shall be

Fig. 3. High Freight Platforms R=not to exceed 5' 8", S=not less than 5' 8" except when such platforms have S=not less than 8' 0".
Fig. 4. High Passenger Platforms on exclusive passenger tracks may have R=height of car floor above rail. Low passenger platforms R=0' 8", S= not less than 5' 0".

Size of Swimming Tank.
Swimming tanks that can be used for swimming contests must be exactly 20 yards in interior length, no less. (A tank 1/2 inch short would be ruled out of contest.) Eight yards wide is best, although 7 yards will pass; 4 feet deep at shallowest point and 3 feet deep at deepest point, which deepest point should be about 12 feet from end where springboard is placed. Depth at springboard

end should be six feet. Interior of tank, both sides and bottom, should be white, and there should be three black lines on the bottom extending parallel with sides, and dividing the tank into four equal alleys; there should be a line across tank on bottom and up sides at exactly 2 yards from each end, measured horizontally, making lines exactly 16 yards apart horizontally.

Size of the Billiard Room and Bowling Alleys.

Table	Outside dimensions	Room space required
1	2 1/2' x 5' 2"	10' x 12'
2	3' x 6' 3"	11' x 14'
3	3 1/2' x 7' 3"	12' x 15'
4	4' x 8' 4"	14' 2" x 18'
5	4 1/2' x 9' 4"	14' 6" x 18' 9"
6	5' x 10' 5"	15' x 20'
7	6' x 12' 6"	16' x 22'

1 is essentially a children's table, 2 and 3 sizes are provided to meet restricted space conditions, all sizes are adaptable to home use, sizes 4, 5 and 6 especially, 5 and 6 are the dominant commercial or club sizes, 7 English style standard cue length 57".

For dimensions required to use two or more tables of any size or sizes furnished, see manufacturer. For a single pair of 2 Regulation bowling alleys.
The length from back wall to the front of the approach, should never be less than 82 ft. This allows for pit and swinging cushion 4 ft. for alleys (to foul line) 63 ft. and for approach 15 ft. Width is 11'x5 1/4" but can be reduced if necessary. Space for players' seats for spectators should be in addition to the lengths and widths given. All drawings show concrete foundation construction which is necessary for basement installation, first floors where there is no basement.

MASONRY, PLASTERING AND FIREPROOFING.

Weight of Brickwork

Placing the weight of brickwork at 112 lb. per cubic foot, the weights per superficial foot for different walls are:

9 inch wall.....	84 lb.
13 inch wall.....	121 lb.
18 inch wall.....	168 lb.
22 inch wall.....	205 lb.
26 inch wall.....	243 lb.

Measurement of Old Brick

Uncleaned rough from building dumped from 8 to 10 bricks per cubic foot, or average of 111 cubic feet to the M.

Uncleaned stacked on outside and interior of stack filled promiscuously 10-12 per cubic foot, or average of 91 cubic feet to the M.

Cleaned and closely stacked, 16 to 18 bricks per cubic foot, or actual average of 59 cubic feet to M. (Usually sold at 60 cubic feet to M to allow for waste and poor piling.)

Cleaned stacked on outside and interior filled promiscuously, 12 to 14 per cubic foot, or actual average of 77 cubic feet to M. (When sold from pile measure customary to count 80 cubic feet to M, to allow for waste and bats.)

Measurement of New Brickwork

The Chicago Masons and Builders' Association have arbitrarily assumed that a cubic foot of wall contains $22\frac{1}{2}$ common brick, or $7\frac{1}{2}$ brick to the superficial foot of 4-inch wall and 15 brick to the superficial foot of 8-inch wall. These figures of the Masons' and Builders' Association are frequently used for the appraisal of party walls, etc., but if so used, the price per M for work in wall should be reduced accordingly.

The actual number of Chicago common brick required for a cubic foot of solid wall varies from $17\frac{1}{2}$ to $19\frac{1}{2}$, and masons in purchasing brick usually reserve 18 brick per cubic foot of solid wall; and when so doing, rarely find an excess or shortage at the end of construction. When the walls are divided into many small piers, requiring much cutting, and consequently much waste, it is best to figure 20 brick to the cubic foot.

On account of the wide variance of practice on the part of masons in estimating, architects, when calling for estimates on brick work by the thousand, will avoid useless controversy by stipulating that quantity of brick will be determined by superficial wall measurement according to the following rule, which is very nearly correct, as Chicago brick now run. Divide the total number of superficial feet of wall surface of a given thickness by 160, and multiply the result by the number of brick widths the wall is thick, and the result will equal the number of thousands of brick contained. A four-inch wall will contain $6\frac{3}{4}$ brick to the superficial foot, or 1,000 brick to 160 square feet.

Miscellaneous Masonry Data

One hundred yards of plastering will require fourteen hundred laths, four and a half bushels of lime, four-fifths of a load of sand, nine pounds of hair and five pounds of nails, for two-coat work.

A load of mortar measures a cubic yard, requires a cubic yard of sand and nine bushels of lime, and will fill thirty hods.

A bricklayer's hod measuring one foot four inches by nine inches, equals 1.296 cubic inches in capacity, and contains twenty bricks.

A single load of sand or other materials equals a cubic yard.

Cement Mortars

Recent developments in building codes and construction practice have shown a marked tendency toward the more extended use of portland cement mortars.

Where greatest strength is required cement and sand mortar is almost invariably recom-

mended; for a mortar with easy working and good weathering qualities, and with sufficient strength for all ordinary purposes, equal parts of cement and lime, with six parts of sand, is the formula generally adopted. The following paragraphs suggest good practice in specifying various types of mortar:

Mortar

Portland cement mortar used in laying up masonry shall be mixed in the proportion of one part of portland cement to not more than three parts of sand, measured by volume. Hydrated lime or lime putty may be added to an amount not exceeding 15 per cent, by volume, of the portland cement used.

Cement-and-lime mortar shall be mixed in the proportion of one part of portland cement and one part of lime to not more than 6 parts of sand, all by volume.

Lime or natural cement mortar shall be mixed in the proportion of one part of lime or cement to not more than 3 parts of sand measured by volume.

Whenever cement-and-lime mortar or natural cement mortar is used instead of portland cement mortar, the allowable working stresses on the masonry shall be reduced to 50 per cent of that allowed with portland cement mortar.

Whenever lime mortar is used instead of portland cement mortar, the maximum allowable working stress shall be reduced to 50 per cent of that specified for masonry laid up with portland cement mortar.

Where masonry is to be highly stressed, mortar is often tested. The following table shows what the strength of the various types of mortar should be, where tests are deemed advisable:

Strengths of Mortars Under Typical Field Condition*

Aggregates, by volume	Compressive Strength at 28 days. Average of five 2-inch cubes or cylinders stored in air.	
	Water	Lbs. per Cent ¹ sq. in.
1:3 Portland cement and sand	22	500
1:1:6 Portland cement, hydrated lime and sand.....	25	200
1:1:4 Portland cement, hydrated lime and sand.....	25	300
1:3 Hydrated lime and sand.....	30	30

*See page 30, "Recommended Minimum Requirements for Masonry Wall Construction," Report of Building Code Committee, U. S. Department of Commerce.

¹Percentages in terms of total weight of dry materials. The water proportions given are those ordinarily used for mortar for laying brick; not those necessarily resulting in the greatest mortar strength.

The cleanliness of the sand used has an important effect upon the strength of mortar or concrete. Excessive amounts of silt, clay, loam or organic matter are harmful. The influence of these impurities is somewhat irregular and therefore clean sand should be insisted upon. Care should also be taken not to permit the use of sand which has become mixed with soil at the bottom of storage piles.

The following data will assist in estimating the quantities of material needed for brick work when portland cement mortar is used: Ordinarily approximately 13.8 cu. ft. of mortar is required to lay 1,000 brick. 2.4 barrels of cement and 1.06 cu. yds. of sand are required to produce 1 cu. yd. of cement mortar. It is customary to assume that one bag of portland cement equals 1 cu. ft. and that a bag of hydrated lime equals about $1\frac{1}{4}$ cu. ft. In proportioning mortar, if the sand is thoroughly dry, a small reduction in the standard amount of sand used is desirable.

OVERLAYING CONSTRUCTION SHEET, SHINGLE AND COMPOSITION COVERING.

FILE 685.1

The average width of a shingle is four inches. Hence, when shingles are laid four inches to the weather each shingle averages 16 square inches, and 900 are required for a square of roofing (100 square feet). If $4\frac{1}{2}$ inches to the weather, 800; 5 inches, 720; $5\frac{1}{2}$ inches, 655; 6 inches, 600.

Slating.

FILE 685.2

Slating is estimated by the "square," which is the quantity required to cover 100 square feet. The slates are usually laid so that the third laps the first three inches.

Number of Slates per Square.

Size in Inches.	Pieces per Square.	Size in inches.	Pieces per Square.	Size in Inches.	Pieces per Square.
6 × 12	533	8 × 16	277	12 × 20	141
7 × 12	457	9 × 16	246	14 × 20	121
8 × 12	400	10 × 16	221	11 × 20	137
9 × 12	355	9 × 18	213	12 × 22	126
7 × 14	374	10 × 18	192	14 × 22	108
8 × 14	327	12 × 18	160	12 × 24	114
9 × 14	291	10 × 20	169	14 × 24	98
10 × 14	261	11 × 20	154	16 × 24	86

The weight of slate per cubic foot is about 174 pounds, or per square foot of various thicknesses as follows:

Thickness in inches.....	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$
Weight in pounds.....	1.81	2.71	3.32	5.43	7.25

The weight per square foot of roof tiling, set in iron or between wood rafters ready for slating, is about 12 pounds.

Tin Roofs.

Tin roofs should be laid with cleats.

There are two kinds of tin—"bright tin," the coating of which is all tin, that is, the tin proper; and "tern," "leaded," or "roofing" tin, the coating of which is a composition, part tin and part lead. This last will not rust any quicker, but the sulphur in soft coal smoke eats through the "leaded" coating sooner than through the "tinned."

Sizes of tin, 10 by 14 and 14 by 20, and two grades of thickness—IC light, and IX, heavy. For a steep roof (one-sixth pitch or over) the IC 14 by 20 tin ("leaded" if high up where little smoke will get to it; "bright" if low down), put on with a standing groove, and with the cross seams put together with a double lock, makes as good a roof as can be made. For flat roofs IX 10 x 14 "light" is best, laid with cleats, but the others make good roofs and any of them will last twenty-five years at least, if painted periodically.

Number of Square Feet a Box of Roofing Tin Will Cover.—For flat seam roofing, using $\frac{1}{2}$ -inch locks, a box of "14 by 20" size will cover about 192 square feet, and for standing seam, using $\frac{3}{8}$ -inch locks and turning $1\frac{1}{4}$ and $1\frac{1}{2}$ inch edges, making 1-inch standing seams, it will lay about 168 square feet.

For flat seam roofing, using $\frac{1}{2}$ -inch locks, a box of "28 by 20" size will cover about 399 square feet, and for standing seam, using $\frac{3}{8}$ -inch locks and turning $1\frac{1}{4}$ and $1\frac{1}{2}$ inch edges, making 1-inch standing seams, it will lay about 365 square feet.

Every box of roofing plates (IC or IX "14 by 20" or "28 by 20" sizes) contains 112 sheets.

For roofs and gutters use seven-pound lead; for hips and ridges, six-pound; for flashings, four-pound.

Gutters should have a fall of at least one inch in ten feet.

No sheet lead should be laid in greater length than ten or twelve feet without a dip to allow for expansion.

Joints to lead pipes require a pound of solder for every inch in diameter.

SANITARY EQUIPMENT

INCLUDING PLUMBING AND HEATING

Capacity of Cisterns.

FILE 697.5

For a circular cistern, square the diameter and multiply by .7854, for the area; multiply this by 1,728 and divide by 231, for number of gallons of one foot in depth; for a square cistern, multiply length by breadth, and proceed as above.

CIRCULAR CISTERN.

5 feet in diameter holds 4.66 bbls.
 6 feet in diameter holds 6.71 bbls.
 7 feet in diameter holds 9.13 bbls.
 8 feet in diameter holds 11.93 bbls.
 9 feet in diameter holds 15.10 bbls.
 10 feet in diameter holds 18.65 bbls.

SQUARE CISTERN.

5 feet by 5 feet holds 5.92 bbls.
 6 feet by 6 feet holds 8.54 bbls.
 7 feet by 7 feet holds 11.63 bbls.
 8 feet by 8 feet holds 15.19 bbls.
 9 feet by 9 feet holds 19.39 bbls.
 10 feet by 10 feet holds 23.74 bbls.

Wrought-iron Welded Pipe.

DIMENSIONS, WEIGHTS, ETC., OF STANDARD SIZES FOR STEAM, GAS, WATER, OIL, ETC.

Inside Diameter	Outside Diameter	External Circumference, A	Length of Pipe per Sq Foot of Outside Surface.	Internal Area	External Area.	Length of Pipe containing one Cubic Foot.	Weight per Foot of Length	No. of Threads per Inch of Screw.	Contents in *Gallons per Foot.	Weight of Water per Foot of Length.
In.	In.	In.	Ft.	In.	In.	Ft	Lbs.			Lbs.
1/8	40	1 272	9.44	012	129	2,500	.24	27	.0006	.005
1/4	54	1 626	7.075	049	229	1,385	.42	18	.0026	.021
3/8	67	2 121	5.657	110	358	751.5	.56	14	.0057	.047
1/2	84	2 652	4.502	196	554	472.4	.84	14	.0102	.085
3/4	1 05	3 299	3 637	441	866	270.	1.12	11 1/2	.0230	.190
1	1 31	4 134	2 903	785	1 357	166.9	1 67	11 1/2	.0408	.349
1 1/4	1 66	5 215	2 301	1 227	2 164	96.25	2.25	11 1/2	.0638	.527
1 1/2	1 9	5 969	2.01	1 767	2 835	70.65	2.69	11 1/2	.0918	.760
2	2 37	7 461	1 611	3 141	4 330	42.36	3.66	8	.1632	1.356
2 1/2	2 87	9 032	1 328	4 908	6 491	30.11	5.77	8	.2550	2.116
3	3 5	10 996	1 091	7 068	9 621	19.49	7.54	8	.3973	3 049
3 1/2	4	12 566	955	9 621	12 566	14.56	9 05	8	.4998	4 155
4	4 5	14 137	849	12 566	15 904	11.31	10.72	8	.6525	5 405
4 1/2	5.	15 708	765	15 904	19 635	9 03	12.49	8	.8263	6 851
5	5 56	17 475	629	19 635	24 299	7 20	14.56	8	1.020	8 500
6	6 62	20 813	577	28 274	34 471	4 98	18 76	8	1 469	12 312
7	7 62	23 954	505	38 484	45 663	3 72	23 41	8	1 999	16 662
8	8 62	27 096	.444	50 265	58 426	2 88	28 34	8	2 611	21 750
9	9 68	30 433	394	63 617	73 715	2 26	34 67	8	3 300	27 50 1
10	10 75	33 772	355	78 540	90 792	1 80	40 64	8	4 081	34 000

* The Standard U S. gallon of 231 inches.

Divide the external circumference column, A, by 12 and the result will be the square feet of surface per lineal foot.

Grade Per Mile.

The following table will show the grade per mile:

An inclination of

1 foot in 15 is 352 feet per mile.
 1 foot in 20 is 264 feet per mile.
 1 foot in 25 is 211 feet per mile.
 1 foot in 30 is 176 feet per mile.
 1 foot in 35 is 151 feet per mile.

1 foot in 40 is 132 feet per mile.
 1 foot in 50 is 106 feet per mile.
 1 foot in 100 is 53 feet per mile.
 1 foot in 125 is 42 feet per mile.

To find quantity of water elevated in one minute running at 100 feet of piston speed per minute: Square the diameter of the water cylinder in inches and multiply by 4. Example: Capacity of a 5-inch cylinder is desired. The square of the diameter (5 inches) is 25, which, multiplied by 4, gives 100, the number of gallons per minute (approximately).

Quantity of Brickwork in Barrel Drains and Wells.

Diameter in Clear	Thickness of Brickwork	Superficial Feet of Brickwork in One Linear Yard.	Number of Bricks Required for One Linear Yard
1 foot, 0 inches	0 feet, 4½ inches	16 feet, 6 inches	115
1 " 6 "	0 " 4½ "	21 " 2 "	148
2 " 0 "	0 " 4½ "	25 " 10 "	181
2 " 0 "	0 " 9 "	33 " 0 "	462
2 " 6 "	0 " 9 "	37 " 8 "	528
2 " 6 "	1 " 1 "	43 " 2 "	906
3 " 0 "	0 " 9 "	42 " 6 "	594
3 " 0 "	1 " 1 "	47 " 10 "	1004
3 " 6 "	0 " 9 "	47 " 1 "	659
3 " 6 "	1 " 1 "	52 " 7 "	1104
4 " 0 "	0 " 9 "	51 " 10 "	725
4 " 0 "	1 " 1 "	57 " 3 "	1203
5 " 0 "	0 " 9 "	61 " 3 "	857
5 " 0 "	1 " 1 "	66 " 9 "	1402
6 " 0 "	1 " 1 "	76 " 1 "	1597
7 " 0 "	1 " 1 "	85 " 6 "	1795

Tests for Pure Water.

Color: Fill a clean long bottle of colorless glass with the water; look through it at some black object. It should look colorless and free from suspended matter. A muddy or turbid appearance indicates soluble organic matter or solid matter in suspension. **Odor:** Fill the bottle half full, cork it, and leave it in a warm place for a few hours. If when uncorked it has a smell the least repulsive, it should be rejected for domestic use. **Taste:** If water at any time, even after heating, has a disagreeable taste, it should be rejected.

A simple semi-chemical test is known as the "Heisch test." Fill a clean pint bottle three-fourths full of the water; add a half-teaspoonful of clean granulated or crushed loaf sugar; stop the bottle with glass or a clean cork and let it stand in a light and moderately warm room for forty-eight hours. If the water becomes cloudy, or milky, it is unfit for domestic use.

Capacity of Drain Pipe.

SIZE OF PIPE.	GALLONS PER MINUTE.							
	¼-in. Fall per 100 ft.	3-in. Fall per 100 ft.	6-in. Fall per 100 ft.	9-in. Fall per 100 ft.	12-in. Fall per 100 ft.	18-in. Fall per 100 ft.	24-in. Fall per 100 ft.	36-in. Fall per 100 ft.
3-inch	21	30	42	52	60	74	85	104
4 "	36	52	76	92	108	132	148	184
6 "	84	120	169	206	240	294	338	414
9 "	232	330	470	570	660	810	930	1140
12 "	470	680	960	1160	1360	1670	1920	2350
15 "	830	1180	1680	2040	2370	2920	3340	4100
18 "	1300	1850	2630	3200	3740	4600	5270	6470
20 "	1760	2450	3450	4180	4860	5980	6850	8410

Table showing the velocity of discharge of different sized sewers.

Diam. of pipe.	180 feet per minute, 3 feet per second.		270 feet per minute, 4½ feet per second.		360 feet per minute, 6 feet per second.		540 feet per minute, 9 feet per second.	
	Fall.	Gallons per minute.	Fall.	Gallons per minute.	Fall.	Gallons per minute.	Fall.	Gallons per minute.
3.....	1 in 69	54	1 in 30.4	81	1 in 17.2	108	1 in 7.6	162
4.....	1 in 92	96	1 in 40.8	144	1 in 23.	192	1 in 10.2	288
6.....	1 in 138	216	1 in 61.2	324	1 in 34.5	432	1 in 15.3	648
9.....	1 in 207	495	1 in 92.	742.5	1 in 51.7	990	1 in 23	1,485

Transmission of Heat by Various Substances.

FILE 697.43

Window glass being.....	1,000	Brick (rough)	200 to 250
Oak or Walnut.....	66	Brick Whitewashed	200
White Pine	80	Granite or Slate.....	250
Pitch Pine	100	Sheet Iron	1,030 to 1,110
Lath and Plaster.....	75 to 100		

Table Showing Amount of Glass Surface which may be Heated by 1 Square Foot of Radiating Surface in Good Buildings.

Temperature of radiating surface (radiators) Fahr.....	Hot Water.			Steam.	
	160°	180°	200°	227° 5 Lbs.	240° 10 l bs.
Square Feet of Glass to 1 Square Foot Radiator Surface.					
Temperature above surrounding air 90°	1.9	2.3	2.8	3.3	3.8
" " " " 80°	2.3	2.9	3.5	4.0	4.6
" " " " 70°	3.0	3.6	4.2	5.0	5.7
" " " " 60°	4.0	4.6	5.25	6.0	7.0
" " " " 50°	5.0	6.0	6.8	8.0	9.0
" " " " 40°	6.9	8.0	8.2	10.0	11.5

Formulae for Figuring Radiation for Factories.

A formula for figuring radiation which is used by some of the best heating engineers in determining the amount of radiation for factory buildings is as follows: $\frac{G}{3.3} + \frac{W}{10.9} + \frac{V}{171} =$ sq. ft. of radiation in which, G = Glass Area.
W = Net Wall Area.
V = Volumn of air in the Room.

SIZE OF STANDARD FLUE LINING ON SALE ON THIS MARKET.

Outside size.	Inside size.	Inside area.
4¼ x 8½ in.	3½ x 7¼ in.	22.6 sq. in.
8½ x 8½ in.	7 x 7 in.	49 sq. in.
13 x 13 in.	11½ x 11½ in.	135 sq. in.
4½ x 13 in.	3½ x 11½ in.	36.5 sq. in.
8½ x 13 in.	6½ x 11½ in.	77 sq. in.
13 x 18 in.	11½ x 16½ in.	193 sq. in.
8½ x 18 in.	6½ x 16½ in.	114 sq. in.
18 x 18 in.	15¼ x 15¼ in.	247 sq. in.
21 x 21 in.	19½ x 19½ in.	
24 x 24 in.	21½ x 21½ in.	

GENERAL RULE FOR BRICK STACKS.

Diameter of base should not be less than 1/10 of height if square, or round, 1/12 of height. Batter of stacks 3/100 of an inch to the foot in height. Thickness of brick work should be not less than one brick from top to 25 feet below same, changing to 1½ brick from 25 feet to 50 feet below top, increasing

½ brick in thickness for each succeeding 25 feet, measuring from the top downward.

Fireplace Flue Areas.

For three-story building, area at top of smoke chamber should be 1/12 of area of fireplace opening.

Two-story building area at top of smoke chamber should be 1/10 of area of fireplace opening.

One-story building area at top of smoke chamber should be ¼ area of fireplace opening.

Throat of fireplace should never be less than 3 in. or more than 4½ in. by the width of fireplace opening.

Front edge of arch should never be thicker than one-half brick, approximately 4 in.

Splay of sides of flue from throat opening up to flue lining should be 2 in. to the foot. The raise from soffit or lintel, or from highest point or soffit to arch should be 6 in.

APPROXIMATIONS OF RADIATION

By Samuel R. Lewis.

The computations for figuring heaters depend on accurate data as to the conductivity of the building and on the temperatures on each side of the wall. The figures should be worked out for each case by a competent engineer.

Steam Radiators

For the average room in a fairly well built house which is to be heated continuously, an approximation of the amount of steam radiation may be obtained by dividing the square feet of glass surface by 2 and the square feet of outside wall, not deducting the glass, by 13; the sum of these two being the sq. ft. of direct cast iron steam heating surface.

Hot Water Radiators

If hot water at 140-180 degrees is to be used the approximate steam radiation would be multiplied by 1.66.

Boilers

The boiler for a steam or water heating system should be selected on the basis of its guaranteed efficiency when burning some specified fuel at a given rate of combustion. For rough approximations with small boilers, the rating of the boiler should be about double the actual radiation. This addition

allows for getting started, for possible unfortunate chimney, inefficient clinker removal, old leaking house, long periods between firing, etc.

One square foot of steam radiation requires from 600 lbs. to 800 lbs. of steam per heating season, or from 70 to 90 lbs. of bituminous coal per season, or about 1,200 cu. ft. of manufactured gas per season, or 4 gallons of average fuel oil per season.

One heat unit will warm .238 lbs. of air one degree at 70 degrees or about 55 cu. ft. of air.

One pound of ice in melting absorbs 144 heat units.

Hospitals and hotels use about 85 gallons of hot water per 24 hours per hot water fixture, plus 1 gallon per piece per day for laundries and plus 3 gallons per meal per person for kitchens.

The following is a fair average over the heating year of the percentages of fuel used during each month in Chicago:

Jan....21%	April....9%	Nov....13%
Feb....18%	May....4%	Dec....17%
March..14%	Oct....4%	Total..100%

PRELIMINARY ELEVATOR PROPORTIONING

During the preparation of preliminary studies for a building it is always necessary to decide on tentative elevator requirements for the different types of buildings required to be designed. The following table of capacities, speeds and type of control for the various classes of buildings represents good general practice, but must be varied to meet special conditions:

	Capacity in Lbs.	Recommended Speed for Floors as shown					Control
		3	4-7	8-12	13-20	21-30	
1. Department Store	2,500-4,000	100	200	300	400	500	Automatic Landing
2. Single Line Store	1,500-2,500	100	300	400			Car Switch Voltage Control
3. Loft Building	2,000-4,000	100	150	250			Car Switch
4. Public Building	2,500-3,500	100	250	400	500		Car Switch with Automatic Landing
5. Hospitals (passenger)	1,500-2,500	100	200	300	400		Dual (both Car Switch and Push Button)
6. Hospitals (service)	1,500-2,500	60	100	150	300		Push Button Control
7. Factory (freight)	4,000-12,000	60	100	150			Car Switch (with landing device if trucking service)
8. Hotel (passenger)	2,000-3,000	100	300	600	600	700	Automatic Landing Device
9. Hotel (service)	1,500-2,500	100	200	400	500	600	Car Switch
10. Apartment Hotel (passenger)	1,500-2,500	100	300	400	500	600	Car Switch Push Button or Dual
11. Garage (auto lift)	4,000-10,000	60	200	300	500	500	Car Switch with Voltage Control
12. Office Building (local service)	2,000-3,000	100	300	400	600	700	Local Run
13. High Office Building	1,500-2,500						Express Run
		10 floors, 600 F.P.M.			10 floors, 600 F.P.M.	Signal Control	
					20 floors, 700 F.P.M.		
					30 floors, 800 F.P.M.		
					40 floors, 800 F.P.M.		
					50 floors, 900 F.P.M.		

Each building is a transportation problem in itself to be solved only when the height of building, area per floor, type of tenants, visiting public and peak traffic periods are fully considered. Tables and figures given here can be taken only as generalities. However, there are certain fundamental considerations and rule of thumb calculations that aid the architects materially in the early drafts of a building.

In general, 25,000 square feet of rental area per elevator will give average service. Tower sections of high buildings are exceptions due to the unproportionate distance of travel. A traffic engineer of a reliable elevator company should early be consulted for tower buildings.

All students of elevator traffic agree that for buildings of 18 stories or more where the elevators are divided into local and express banks, more cars of smaller capacity give quicker emptying time and shorter interval of departure than do fewer large cars. While precedence has established a near standard of 2,500-pound capacity, a study of the traffic problems will show that with cars of 2,000-pound capacity and possibly one additional car bank will improve the handling of the building's population because fewer passengers means fewer stops, and so quicker round trip time.

The A. S. M. E. prescribes 75 pounds per square foot of effective cab area in calculating the carrying capacity of passenger cars. This is based on 150 pounds per person and 2 square feet per person.

There are two major classifications of control as related to electrical energy supply, rheostatic and voltage control. Rheostatic control has the full voltage of the power company's supply brought to the elevator control board. Acceleration and deceleration are obtained by short circuiting portions of the current through resistance grids where the current is dissipated as heat. These steps vary from two to five depending on the running speed of the elevators and are controlled through contacts in the car operator's switch.

Voltage control embodies a constant speed motor generator set for each elevator hoisting motor. Just the amount of current needed to properly accelerate the car is fed to the elevator motor in much the same way a locomotive engineer gradually increases the steam throttle opening. Voltage control gives

infinitely smooth acceleration and deceleration and easy riding qualities which increases the life of equipment and permits economy of operation because no electricity is wasted through grid circuits.

The classifications of control as related to operation are: Push Button, Car Switch, and Signal Control.

Push button control is a general classification for automatic elevators. There are variations, such as Constant Pressure Push Button, Momentary Pressure Push Button, and Collective Control, any one of which may be using either rheostatic or voltage control power. Push button control finds its use in apartments or buildings where the elevators are rarely used. In either case the automatic feature is applied to dispense with an operator. It is inherent then, that proper application can be made only when every one who will use the elevator is familiar with its operation. Thus residential tenants, as in apartment buildings, may be schooled to manipulate the elevator, or the employees of a firm having elevators rarely used.

Car switch control requires the services of an operator to drive the car. This type of control is essential where there is a transitory traffic as in office and public buildings. Where large numbers of people must be handled for peak periods the push button control becomes inadequate and an operator with car switch control becomes a necessity.

Signal control is a combination of the better characteristics of both Push Button and Car Switch controls. It is the latest engineering accomplishment of the industry and embodies the automatic features of the Push Button elevator with its accurate landing at floor levels, but driven by an operator to supply that human element essential where masses are to be handled.

Merely high speed elevators do not mean fast service as seen by the following time analysis of an elevator cycle:

Loading time at main floor.
Time for closing doors and gates.
Accelerating time.
Running time at full speed.
Decelerating time.
Time for opening doors.
Unloading and loading time at all stops.
Time for closing doors and gates.

THE ORDERS AND THEIR APPLICATION

By ALFRED W. S. CROSS, M. A., F. R. I. B. A., and ALAN E. MUNBY, M. A.

Introduction.

So many scholarly works upon the Orders are in existence, that some explanation seems to be called for in introducing another series of articles upon a subject that is, to all appearances, already well worn.

Notwithstanding the consensus of opinion as to the general proportions that ought to be followed in their delineation, an opinion based upon the rules laid down by the architects of an early period of the Renaissance, a surprising divergence from the precepts and practices of these old masters of their art is to be found in many buildings of our own time.

The writers are only aware of the existence of one book which seems to meet the usual office requirements, and that is a work entitled: "Rules for Drawing the Several Parts of Architecture," by James Gibbs, published in 1732; a book that has never been reprinted and copies of which are not now readily obtainable. The object aimed at, and successfully attained, is an illustration and description of an example of each Order, not "after Gibbs," but representing one of a good average type of design so proportioned that the dimensions of the various parts bear simple and easily discernible ratios one to another.

An attempt has been made to co-ordinate the leading features of the book by re-drawing some of the illustrations, retaining the useful dimensions shown thereon and entirely re-writing the description of the plates, with the introduction of some general principles likely to be of value to the draughtsman and student, for which purpose the opinions of standard writers, particularly those of Sir William Chambers, have been freely incorporated.

Before attempting such a condensation of the material in the book it was thought desirable to ascertain how far the generalizations adopted by Gibbs really represent the proportions used by acknowledged authorities. For this purpose the average ratio of the diameter of the column to the height of the entablature, as being a relation which essentially affects the whole proportion of the Order, was obtained by measuring a number of recognized examples, and it may be of interest to give the results, as an indication of the actual value of the dimensions used.

The result renders it evident that the general proportions of the Orders as recommended for adoption by this architect are fully worthy of confidence.

Hence, it would obviously seem preferable to master a few main dimensions, and having thus inculcated a general sense of proportion, to rely upon gaining familiarity with the plates by constant use, when the proportions of the smaller members of the compositions will become naturally assimilated. The Composite Order is given in Gibbs' book, but, owing to its similarity to the Corinthian and to the absence of a consensus of opinion as to its dimensions, it has not been included in the present work.

No encroachments have been shown on any of the Orders to avoid distracting attention from the dimensions. With the exception of the whole of the Tuscan Order and of the frieze of the Ionic Order there are few members, apart from mere fillets, which have not been enriched, by some form of ornament. In one or another example, the Doric naturally the least and the Corinthian the most. In the latter Order, in fact, even the cyma and corona of the cornice, in addition to the frieze, ogees and beads, are often ornamented, but, apart from the question of expense, it is undesirable to carry such elaboration too far, as when placed in close contact with each other, especially when a distant view is alone possible, one moulding will often rob another of its effect, and, indeed, the value of richness of detail is more often than not lost in this manner.

The enrichment of columns beyond ordinary flutings is generally to be deprecated, while the application of ornament to bases and pedestals is seldom either requisite or desirable.

However great may be the utility of drawings dealing with the Orders, it should never be forgotten that they are merely a means to an end, that end being an executed building. Those whose work is confined to a drawing board develop a strong tendency to consider their compositions solely from an elevational and artistic draughtsman's point of view, and every opportunity should be taken of checking this habit and of cultivating the art of thinking "in the round." The study of per-

TABLE SHOWING THE APPROXIMATE RATIO BETWEEN THE LOWER DIAMETER OF THE COLUMN AND THE HEIGHT OF THE ENTABLATURE.

Tuscan.	Doric.	Ionic.	Corinthian.
Alberti .....1:1.5	Alberti .....1:2.0	Alberti (1:1.4)	Alberti .....1:1.8
Palladio .....1:1.8	Palladio .....1:1.9	..... (1:1.7)	Palladio .....1:2.0
Scamozzi .....1:1.9	Scamozzi .....1:2.1	Palladio .....1:2.0	Scamozzi .....2:2.0
Vignola .....1:1.8	Vignola .....1:2.0	Scamozzi .....1:1.8	Vignola .....1:2.5
—	Parthenon .....1:2.0	Vignola .....1:2.3	Pantheon .....1:2.3
—	Baths, Diocletian 1:2.0	Fortuna (Rome) 1:2.3	Jupiter Stator 1:2.5
—	Temple Paestum 1:1.7	Baths, Diocletian 1:1.9	Jupiter Tonans 1:2.2
—	Apollo, Delos 1:1.8	Minerva, Athens 1:2.3	Temple Antonius 1:2.3
St. Paul's Convent	Bow Church,	Illius, Athens...1:2.3	
Garden .....1:1.8	Portico .....1:1.9	Banqueting Hall 1:2.0	Hamnden Court. 1:2.2
Average ....1:1.76	Average .....1:1.93	Average .....1:2.00	Average .....1:2.00
Gibbs .....1:1.75	Gibbs .....1:2.00	Gibbs .....1:1.82	Gibbs .....1:2.00

The above examples have not been selected with any intention of justifying the proportions adopted by Gibbs, but are merely cited as those which readily occurred to the mind, or of which the dimensions could be easily obtained.

spective of buildings, and, best of all, the preparation of models of portions of a proposed building, an occupation which often results in the discovery of latent defects of design, are alike of the greatest educational value to the student of architecture.

THE SETTING UP OF AN ORDER.

(To be studied in connection with Plates I., II., III., IV. and V.)

The sequence followed in setting up an Order will be found to influence, to some extent, the rapidity and facility with which it can be accomplished. An outline of the method of procedure may, therefore, prove useful.

Usually the height of the Order is fixed by circumstances, as, for example, when it is to be applied to a given story of a building.

The total height having been settled, draw the limiting horizontal lines and then set out the vertical centre lines of the columns, thus dividing the frontage to be treated into bays appropriate to the exigencies of the design and having due regard to the correct intercolumniation of the Order adopted. If a pedestal is to be placed under the column, cut off one-fifth of the total height for it, and cut off one-fifth or one-sixth of the remainder (measured from the top limiting horizontal line) for the vertical height of the entablature; the intervening space gives the height of the column, including its cap and base. If no pedestal is to be used, divide the whole of the given height into five or six parts, cut off one of these parts, from the top, for the entablature, and the remainder gives the height of the column.

The Column. Since some of the dimensions of the entablature are in terms of the diameter of the column, the latter should be next developed. The term "diameter of the column" refers always to its greatest diameter—namely, that of the shaft just above the lower cincture. This dimension is one-seventh to one-tenth of the height between the soffit of the entablature and the top of the pedestal, or lower limit of the Order in the absence of a pedestal. If the centre lines of the piers do not represent the centres of the columns, as, for instance, when coupled columns are used, the centre line of one of the columns must now be decided upon and the diameter of the Order symmetrically disposed horizontally across it. A semi-diameter is then cut off, from the bottom of the column, for the height of the base, and it should be noticed that this—except in the Tuscan and alternative Doric Orders—does not include the fillet at the base of the shaft, the members above the upper torus being reckoned as part of the shaft, as are also the astragal and fillet below the necking of the capital of the column. The plinth and lower torus of the base project one-third and the upper torus one-fifth of a semi-diameter beyond the lower circumference of the shaft. The leading lines for the base having thus been obtained, cut off by a horizontal line the height of the capital from the top of the column, and (except in the Ionic Order) again below it, a height equal to one-sixth of a semi-diameter for the astragal and fillet below the necking.

The semi-diameter of the shaft at one-third of its height from the bottom is then divided into five or six parts, and four or five of these parts are taken as a semi-diameter at the top, below the astragal. The shaft may now be completed, the entasis being usually made to start from the greater diameter, one-third up the shaft, below which point it is a true cylinder until the cincture at the base is reached. This is the best method to adopt in the case of small scale drawings. Where large detailed drawings are in question the diameter may be alternatively divided at the base of the shaft instead of at one-third of

the height, and the entasis extended throughout the whole length. The completion of the shaft enables the projection of the capital to be marked off, and also that of the astragal and fillet, which is equal to their combined height.

The Entablature. The development of the entablature can now be proceeded with, the architrave, frieze and cornice being ruled off horizontally and the members of each inserted (see dimensions). The projections for a returned end or section are obtained from the upper diameter of the shaft. The lowest member of the architrave, and also the frieze, lie vertically over the circumference of this upper end of the shaft. The projection of the cornice beyond the frieze line is equal to its height, except in the Doric Order, in which the projection is one-third more than its height of one diameter. Further rules dealing with minor projections and the position of the modillions, dentils, etc., will be supplied by a study of the plates and tabulated dimensions.

Pedestal. Finally, the pedestal, if any, should be divided vertically into four parts; the lower part is ruled off for the height of the plinth, one-third of the second part for the height of the base, and one-half of the top part for that of the cap. The projection of the die is equal to that of the base of the column, and the plinth and the cap of the pedestal extends beyond this for a distance equal to the height of the base of the pedestal previously obtained.

The above dimensions will all be found in the subjoined table, which represents an endeavour to bring together, in a form suitable for reference, sufficient information to make any glaring disproportion impossible.

A few of the minor divisions are only approximations; they will, however, be found to be sufficiently accurate for any but large detail drawings, in which it is not desirable to destroy all individuality by rigorous mechanical rules.

On the left hand will be found the dimension required and, in the intermediate column the fraction for each Order of the previously ascertained unit given in the right-hand column.

Plate I.

Plate I. represents the four Orders drawn to a common vertical height.

The pedestal may or may not be required and, if used, it is to be regarded as an addition to the Order, the relative dimensions of the parts of which are not altered by its removal or introduction.

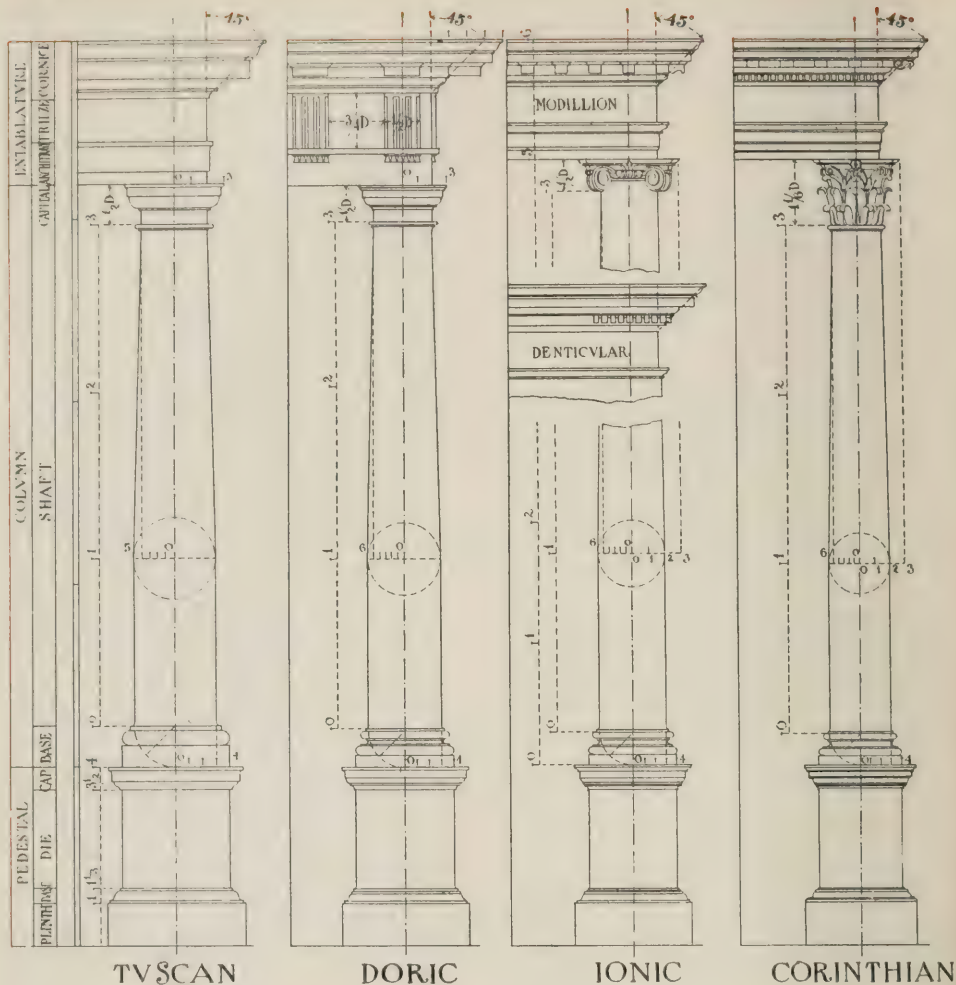
The diameter of the column (by which is meant the diameter of the shaft following its lower cincture) is the ruling dimension from which most of the others are obtained, and the smaller circumference of the top of the shaft always coincides with the frieze line from which all the projections of the entablature are set out.

In judging the value of such projections it should be borne in mind that in execution the higher vertical faces of the composition will usually be much foreshortened to the observer and that there will be a consequent increase in the comparative value of neighboring projections.

A perusal of the table will indicate those dimensions which all the Orders have in common, but for convenience of reference they are further summarized thus:

Height of Pedestal, $\frac{1}{2}$ total height of Order.

PLATE 1.



Height of Plinth, $\frac{1}{4}$ height of Pedestal.
 Height of Pedestal Base, $\frac{1}{2}$ height of Pedestal Plinth.
 Height of Pedestal Cap, $\frac{1}{2}$ height of Pedestal Plinth.
 Projection of Cap and Plinth, $\frac{1}{2}$ height of Pedestal Plinth.
 Projection of Corona over Die, $\frac{3}{4}$ projection of Pedestal Cap.
 Height of Column Base, $\frac{1}{2}$ diameter of Column.
 Projection of Base over Shaft, $\frac{1}{2}$ semi-diameter of Column.

Pilasters. The general proportions allotted to the columns of the Orders apply also to pilasters, which may be regarded as columns square on plan, but almost universally deeply engaged. The projection of pilasters must be regulated by circumstances. If impost mouldings or other projections stop upon them, as on the inner wall of an arcade, these projections must be sufficient to take the mouldings, and if they line with engaged columns crowned by an entablature, they must have a projection similar to the columns, and therefore in such cases never less than a semi-diameter. Apart from these





















































































































considerations, the projection should be about one-fourth of the diameter. Pilasters may be fluted or plain; if the former, the flutes should be, as far as possible, the same size as those of the adjoining columns, and always an odd number.

On plain faces 7 flutes (occasionally 9) are used, and therefore in the above case 4 flutes (or 5) would be employed on each side of the re-entering angle. The returned sides of pilasters should never be fluted unless the projection is as much as half a diameter. The diameter assigned to a pilaster will be that of a column (if any) used in conjunction with it. The shaft may or may not be diminished.

If the pilaster stand alone it is best formed with the same top and bottom diameter, but if a column stand in front of it then it should be diminished to the same extent as the column. Entasis is not usually given to pilasters.

Unless columns and pilasters are monoliths the shafts should be built up of three drums and not two, as a central joint, unless exceptionally well executed, has a very disagreeable appearance.

**"Practical Notes for Architectural Draftsmen: The Orders and their Application."
Tabulated Dimensions of the Orders. Arranged Progressively as Required for Use.**

Dimension required.				Tuscan.	Doric.	Ionic.	Corinthian.	Dimension = 1.
No Pedestal	Height of Entablature	.	.					Total height of Order.
With Pedestal	Height of Pedestal	.	.					" " " less Pedestal.
THE COLUMN.								
Diameter of Shaft	Height of Entablature	.	.					Height of Order less Entablature and Pedestal.
"	Height of Pedestal	.	.					Diameter of Shaft.
"	Base Plinth	.	.					Height of Base.
"	Lower Torus	.	.					" " less Plinth.
"	Upper Torus	.	.					" " lower Torus.
"	Upper Torus and fillet under Capital	.	.					Diameter of Shaft.
"	Necking	.	.					Height of Capital (Corinthian less Abacus).
"	Top of Neck to top of Ovolo	.	.					" " " " "
"	Abacus	.	.					" " " " "
"	Astragal and fillet	.	.					Semi-diameter of Shaft.
"	Fillet below Astragal	.	.					Height of Astragal and Fillet.
Projection of Base beyond Diameter.								
"	Upper Torus	.	.					Semi-diameter of Shaft.
"	Diminution of Shaft at Top	.	.					" " " " "
"	Projection of Cap over Shaft at Top	.	.					Semi-diameter of Shaft at Top.
"	Cap over Shaft at Base	.	.					Semi-diameter of Shaft.
"	Head at top of Shaft	.	.					" " " " "
THE ENTABLATURE.								
Height of Architrave.	Height of Architrave.	.	.					Height of Entablature.
"	Frieze	.	.					" " " " "
"	Cornice	.	.					" " " " "
"	Fillet and Cyma	.	.					" " " " "
"	Corona and Fillet over Corona	.	.					" " " " "
"	Base of Corona to top of Ovolo	.	.					" " " " "
"	Top of Ovolo to Frieze	.	.					" " " " "
Total projection of Architrave over top diam. of Shaft								
"	top face of Architrave	.	.					Height of Entablature.
"	of Cornice over Frieze	.	.					" " " " "
"	Inset of Corona from top of Cornice	.	.					" " " " "
"	Length of Modillions (or Mutules)	.	.					" " " " "
"	Breadth of Modillions (or Dentils)	.	.					" " " " "
"	Space between Modillions (or Dentils)	.	.					" " " " "
THE PEDESTAL.								
Height of Plinth	Height of Plinth	.	.					Height of Pedestal.
"	Base	.	.					" " " " "
"	Cyma of Base	.	.					" " " " "
"	Fillet below Cyma	.	.					" " " " "
"	Cap	.	.					" " " " "
"	Base of Corona to top of Cap	.	.					" " " " "
"	Projection of Cap and Plinth over Die	.	.					" " " " "
"	Corona of Cap over Die	.	.					" " " " "

Note.—The "Diameter" is always the greatest diameter of the drum of the Column. M. refers to the Modillion Cornice. D. to the alternative Dentil Cornice.

PLATE 2.

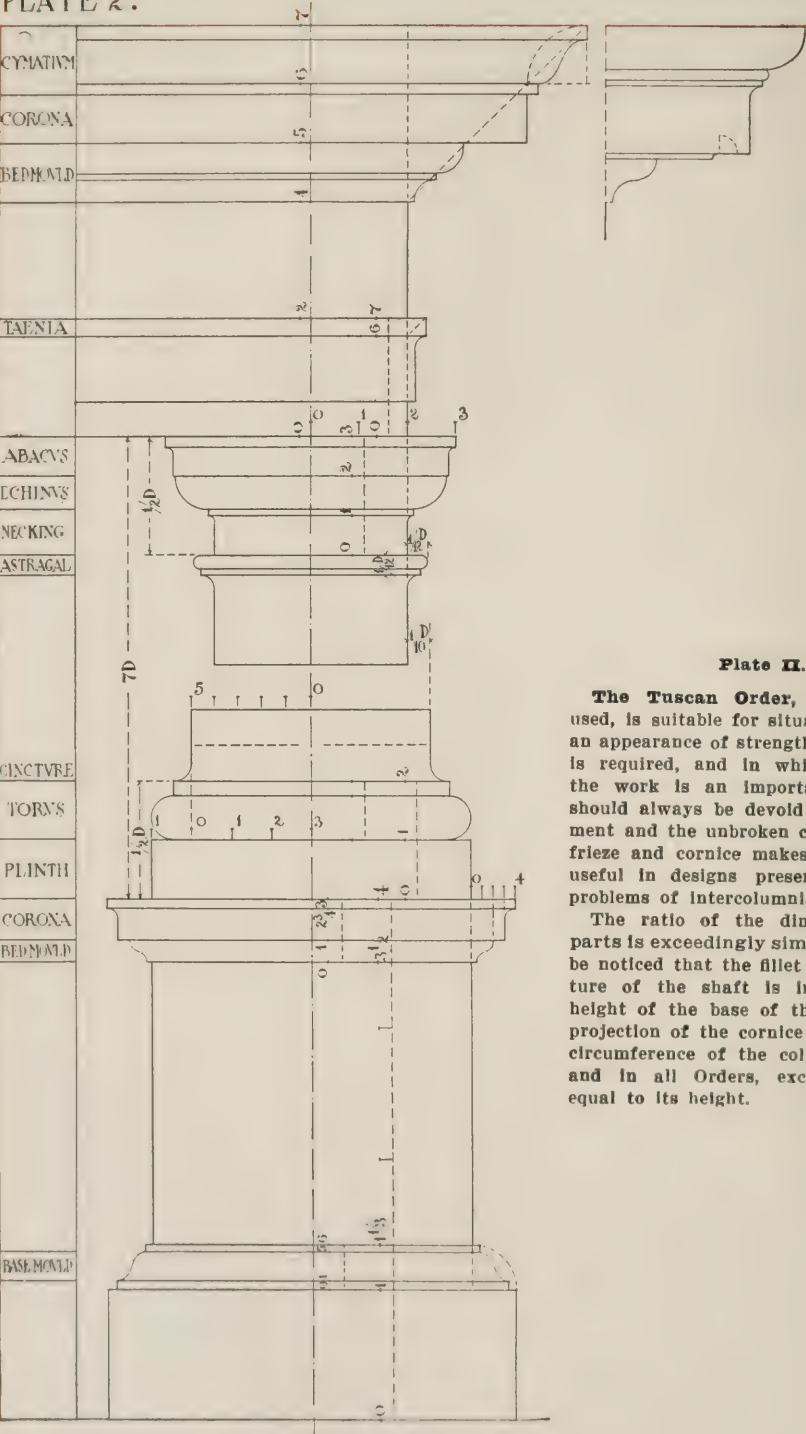


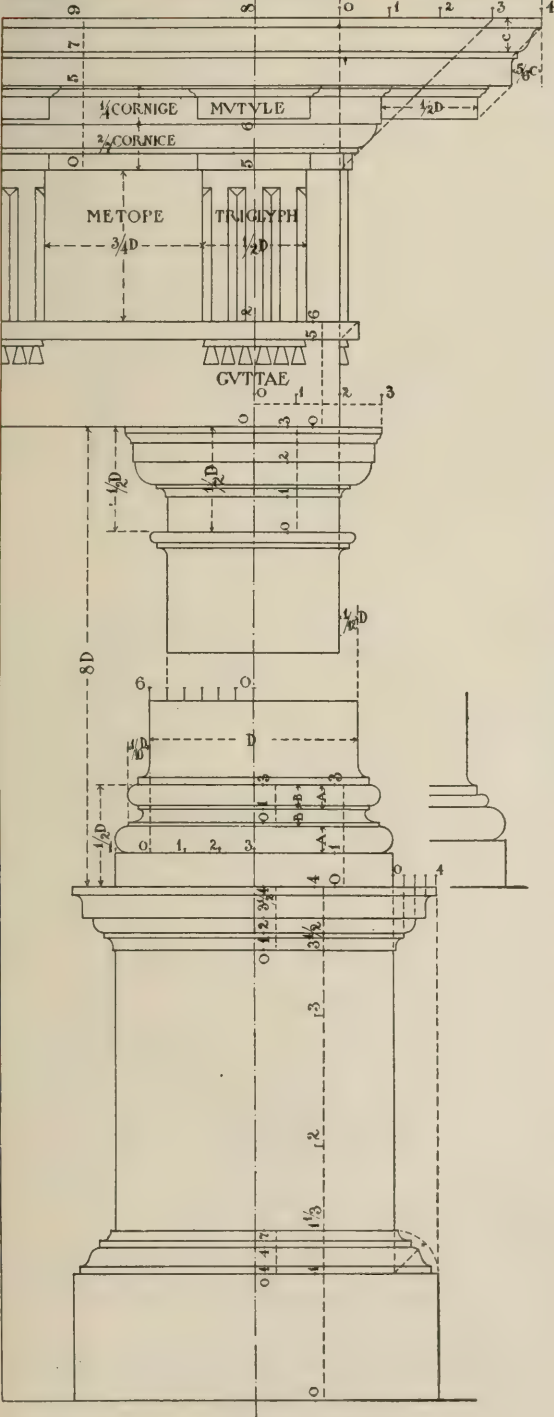
Plate II.

The Tuscan Order, though seldom used, is suitable for situations in which an appearance of strength and simplicity is required, and in which the cost of the work is an important factor. It should always be devoid of any enrichment and the unbroken character of the frieze and cornice makes it particularly useful in designs presenting awkward problems of intercolumniation.

The ratio of the dimensions of its parts is exceedingly simple. It should be noticed that the fillet below the cincture of the shaft is included in the height of the base of this Order. The projection of the cornice over the upper circumference of the column is, in this and in all Orders, except the Doric, equal to its height.

TUSCAN

PLATE 3. MVTLE CORNICE



DORIC

DENTICVLAR CORNICE

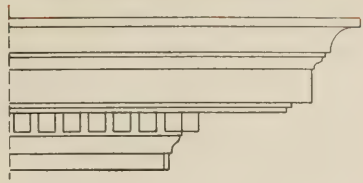
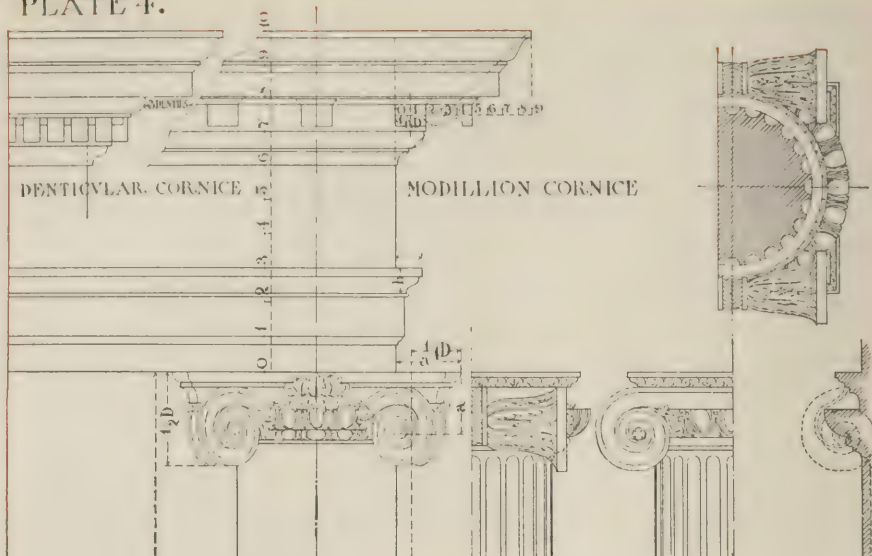


Plate III.

The Doric Order is always effective when used in lower storeys, arcades, and door and window openings, but owing to the triglyphs upon the frieze, which must fall centrally over the columns, it is the most difficult to deal with when spacing is in question.

The dimensions of the cornice do not lend themselves to any simple ratio and its projection is always greater than that adopted for the other Orders. The 45° line from the top of the frieze at once gives the bed mould of the mutule course, and one-third of the height of the cornice added to the top projection of this guiding line gives the total projection, while the mutules are one-half a diameter in side elevation. Some considerable modifications of the Order, as here represented, will be found to exist in many recognised examples. Occasionally the mutules are dispensed with, and their bed mould is cut to form a dentil course, as in the Theatre of Marcellus. The cyma crowning the cornice is often replaced by a cavetto, while the Doric base (shown alternatively on the plate) sometimes replaces the more graceful attic base. When this base is used, the upper fillet should be included in the height of the base, as in the Tuscan Order.

PLATE 4.



CUSHION CAPITAL

Plate IV.

The Ionic Order shows smaller variations from the pure Classic examples than any other, and its proportions are fairly simple.

Two styles of cornices are, however, used, the modillion and the dentil cornice, and although the method adopted by Gibbs of giving prominence to the former has been followed, it should be stated that the latter is more generally found in old examples, whilst the former is preferred by Palladio.

Represented side by side upon the plate the extent of the variation is easily discernible. A modillion or dentil should always be bisected by the centre line of the column and the spacing determined by the distance of this line from the frieze, as set out upon the drawing. The frieze is always plain and in larger works it is, preferably, kept flat. In smaller compositions, however, when narrow or when used over doors and windows a pulvinated frieze may be adopted with good effect.

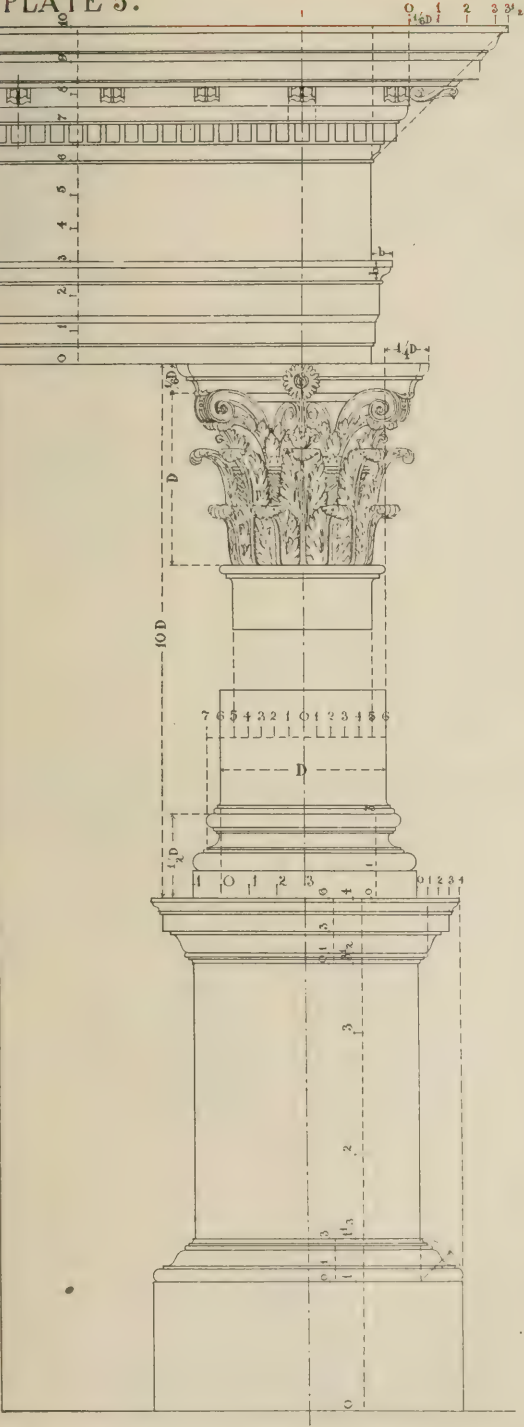
The earlier alternative form of the Ionic capital in which the faces of the volutes are parallel to the plane of the elevation (not shown upon the drawings) may, of course, be substituted for the capital with angle volutes at 45°, though the latter has usually a much more graceful effect, particularly in small compositions. Of course, the geometrical method for setting out the volutes cannot be used in drawing such capitals in ordinary elevation. It should be noticed that the height of the capital in this Order is measured from the soffit of the volutes.

The centre of the eye is one-third of the height of the capital from its bottom and is in elevation placed just outside the top circumference of the shaft, while the horizontal fillet at the top of the shaft is immediately below the eye.

When the column is fluted the width of the fillets should be one-fourth to one-third that of the flutes. The flutes generally number twenty or twenty-four; in the latter case the simple method of setting them out on plan, as shown on the drawing, will be found of service.

The attic base is always used with the Ionic Order.

IONIC



CORINTHIAN

Plate V.

The Corinthian Order has been represented with considerable variations from the original type.

The Ionic entablature was often used by the ancients, supported by Corinthian columns, and the Corinthian cornice itself, though here represented with a dentil band, is often found without one. No general rule appears to exist for spacing the modillions or for their dimensions, the ratio of the width of the modillion to the space between two of them varying from 1 : 1½ to 1 : 2½, and again the number of the dentils between the modillions varies from 2 to 5 in different examples.

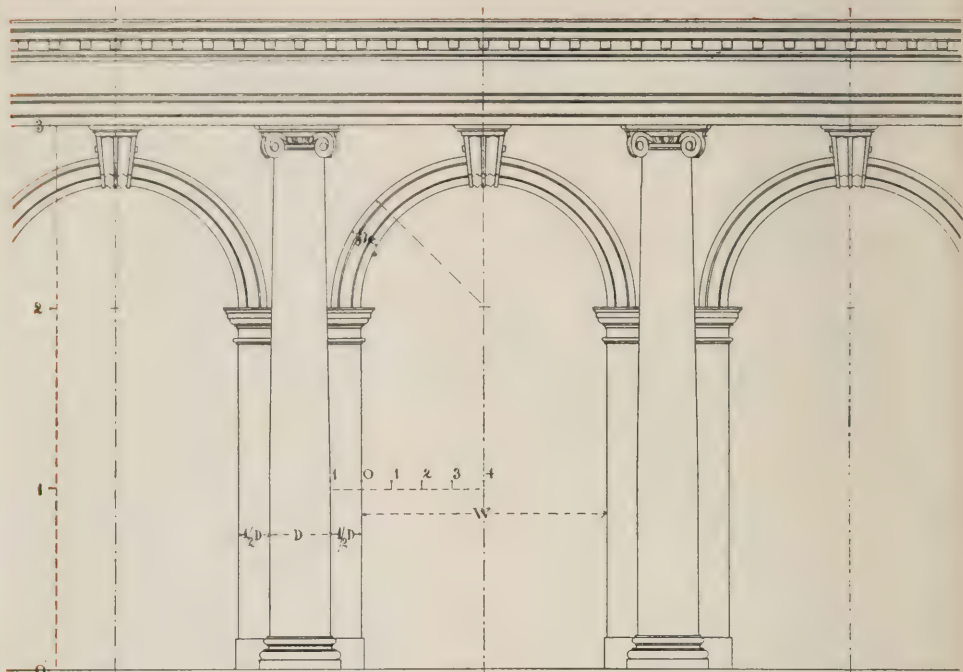
Both features should be symmetrically placed with reference to one another and to the centre line of the column, a point often neglected. To secure this result the following method is recommended:— Draw a modillion one-sixth of the diameter of the column in width, arranged symmetrically over the centre line of the column. Place another with its outside edge three and a half times its width within the total projection of the cornice, and thus obtain the spacing between the blocks. Divide the distance between two modillion centres into 15 parts, give two to a dentil, to be placed symmetrically under a modillion, and one to each space between the dentils, which will be found to bring the inside edge of the last dentil before the return, on the frieze line.

The form and projection of the leaves of the capital are largely matters of individual taste, but the general method of their arrangement will be evident after examining the drawing. It may, however, be noted that the eye of the volute is just outside the lower circumference of the shaft, and that the tiers of leaves divide the capital below the abacus into three approximate equal horizontal sections.

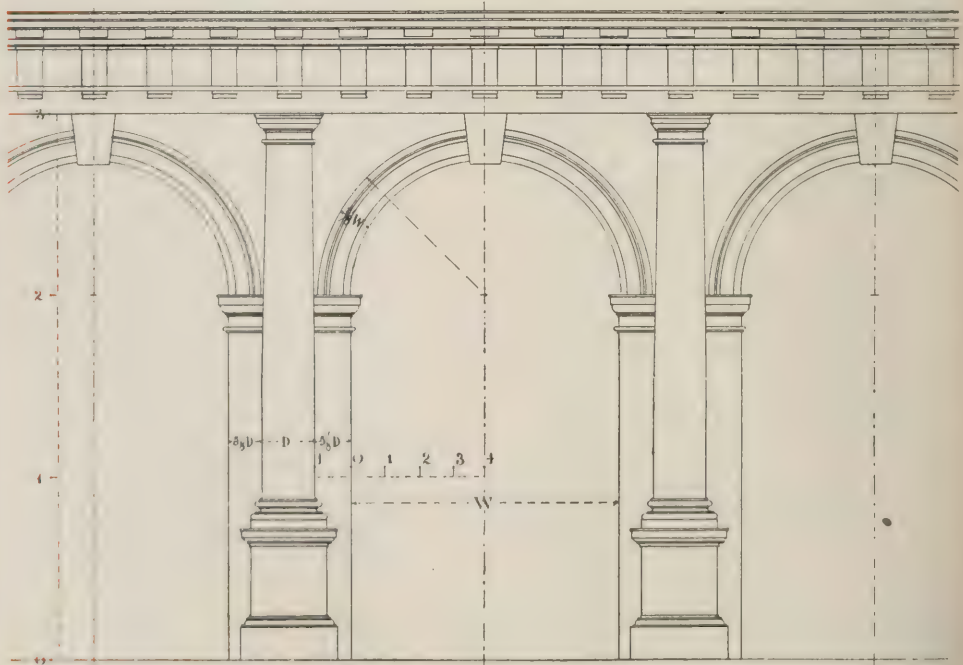
The column may or may not be fluted as in the Ionic Order.

The attic base, as used in the Ionic Order, is very generally employed—in fact, it is often preferable to adopt it, omitting the additional mouldings shown, for the sake of variety, on the drawing.

PLATE 6.



IONIC



DORIC

The relations and dimensions given in this and similar subsequent plates must, therefore, be looked upon as necessarily somewhat elastic. At the same time, such dimensions as are given should not be disregarded, but considered in the light of proportions to be attained as far as the exigencies of the plan will admit.

The spacing of arcading dealt with in this plate should be governed by the height of the space to be treated, and it will be found that the best effects are obtained when the widths of the

seen that a relation exists between the diameter of the column, the width of the plaster, and the width of the opening. Again, the diameter of the column relatively to the opening will be influenced by the presence, or absence, of a pedestal to the Order. The summary shown, collected from Gibbs's work, giving the dimensions to be aimed at in order to comply with the above relations, will be found useful:

The height of the impost should always be about two-thirds of the height from the ground to the soffit of the architrave of the Order, whether a pedestal is in use or not.

	Tuscan.		Doric.		Ionic.		Corinthian.	
	No Ped.	With Ped.	No Ped.	With Ped.	No Ped.	With Ped.	No Ped.	With Ped.
Width of bay centre to center	6	7	6 $\frac{1}{4}$	7 $\frac{1}{2}$	6	7 $\frac{1}{2}$	6 5-12	8 $\frac{1}{2}$
Width of one pilaster	$\frac{1}{2}$	$\frac{2}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{1}{2}$	$\frac{7}{8}$	$\frac{1}{2}$	7-10
Width of opening	4	4 $\frac{7}{8}$	4 $\frac{1}{4}$	5 $\frac{1}{4}$	4	5 $\frac{1}{4}$	4 $\frac{3}{4}$	5 $\frac{1}{2}$

openings approximate to half of their height, and when the total width of the piers lies between one-half and two-thirds of that of the opening.

The spacing must also be considered in reference to the Order employed, so that when triglyphs, or modillions, are placed centrally over the columns their proper spacing may be interfered with as little as possible. It will thus be

The archivolt or moulding running round the arch should be the same width as the plaster (less any necessary clearance for the mouldings)—that is, about one-eighth of the width of the opening, which should also be the height of the impost cap to the bottom of the necking. Further details as to the members will be found on Plate VII.

TVSCAN DORIC IONIC CORINTHIAN

Details are here given of impost mouldings, with their archivolts, suitable for the different Orders. The division of the impost is as simple and similar in each example, the height of the corona and of its mouldings above, if any, being equal to the height of the mouldings below which, again, are equal to the necking. The bead and fillet below the necking are one-sixth of the height of the impost, the bead being double the height of the fillet. The projection of the impost beyond the line of the pilaster is equal to the height of the corona and member over in the

first two Orders, while the projection of the corona itself is equal to this height in the last two.

The pilaster is square on plan, and, therefore, the plan of the archivolt is represented by the square upon which the mouldings are placed. A examination of these mouldings will show that they resemble the architraves given for their respective Orders, and their forms admit of similar variations. It will be noticed that the innermost face is always in the plane of the face of the pilaster, while the projection of the moulding at the extrados increases from about one-quarter the width of the whole archivolt in the Tuscan to one-third in the Corinthian Order.

SUBJECT INDEX.

System of Classification for Filing Data, Drawings, Plates, Catalogues, Etc.,
in Architects' and Contractors' Offices.

INTRODUCTION.

The decimal system of classification was devised and elaborated by Mr. Melvil Dewey, formerly director of the New York State Library. This system was intended primarily for the use of librarians in the classification and arrangement of books and pamphlets, but it was soon found that the system also furnished a simple and effective means of classifying, indexing and filing literary matter of all kinds. Engineers have found it useful for indexing technical data and information, catalogs, reports, card systems, drawings, etc., and it has been found equally useful by manufacturing and business concerns.

The scheme and a considerable amount of the subject matter which follows has been obtained from the original publication of Mr. Dewey, but the outline on "Building," 690 to 699, has been compiled new by the Editor. The purpose of rewriting being to bring the Index more nearly in accord with the trade groups and divisions of modern practice. The index on "Ancient," "Mediaeval" and "Modern Architecture," 722 to 724 inclusive, has been completely revised in order to bring the same down to date in accord with the latest discoveries in the realm of the history of Architecture. For the revision of this material we are deeply indebted to Prof. Rexford Newcomb, Professor of Architecture of the University of Illinois. For its co-ordination with Dewey to Miss Winifred Fehrenkamp, Librarian of the Ricker Library of Architecture, also of the University of Illinois.

EXPLANATION OF THE DECIMAL SYSTEM.

The essential characteristic of the Dewey System is its method of division and sub-division. The entire field of knowledge is divided into nine chief classes numbered by the digits from 1 to 9. Matter of too general a nature to be included in any of these classes is put into a tenth class and indicated by 0. The following are the primary classes of the Dewey System:

- 0 GENERAL WORKS
- 1 PHILOSOPHY
- 2 RELIGION
- 3 SOCIOLOGY
- 4 PHILOLOGY
- 5 NATURAL SCIENCE
- 6 USEFUL ARTS
- 7 FINE ARTS
- 8 LITERATURE
- 9 HISTORY

Each of these classes is again divided into nine divisions, with a tenth division for general matter, and each division is separated into nine sections. The sections are again sub-divided and the process may be carried as far as desired.

It is thought that this system will be especially valuable to architects for classifying drawings, catalogs, reports and technical data. Our space is too limited to publish the complete work, nor is it desirable. Should any one be sufficiently interested to go into the matter thoroughly, they should have Mr. Dewey's complete text on the subject. We are particularly concerned as practitioners of the profession of architecture with divisions 6 and 7, "Useful Arts" and "Fine Arts," comprising the following subject numbers:

- 600 USEFUL ARTS
- 610 MEDICINE
- 620 ENGINEERING
- 630 AGRICULTURE
- 640 DOMESTIC ECONOMY
- 650 COMMUNICATION AND COMMERCE
- 660 CHEMICAL TECHNOLOGY
- 670 MANUFACTURES
- 680 MECHANIC TRADES
- 690 BUILDING

Omitting all sub-divisions of this topic, with the exception of 690 "Building," we publish the sub-divisions of same. As distinguished from "Architectural Construction," "Building" has to do more particularly with the processes of construction and matters pertaining to trades and materials involved in the construction of buildings, should be more properly classified under "Building", while matters as to types and component architectural parts are more properly classified under Architectural Construction.

690 BUILDING — Materials and Trades.

690.0 GENERAL.

.01 History.

- .011 History of Materials.
- .012 History of the Art of Building.
- .013 Biography of Architects.
- .014 Biography of Builders.
- .015 Biography of Craftsmen.

.02 Organization of Construction.

.03 Finance of Building.

- .03-A Thru Building & Loan Associations.
- .03-B Thru Cooperative Ownership.
- .03-C Thru Bond Issue.
- .03-D Thru Straight Loan.
- .03-E Thru First and Junior Bonds.

.04 Operation of Buildings.

.05 General Works on the Occupation and Art of Building.

- .50 Encyclopaedia.
- .051 Manuals.
- .052 Handbooks.
- .053 Receipts.
- .054 Periodicals.
- .055 Society Proceedings.
- .056 Trade Unions, Guilds, Etc.
- .057 Contractor's Associations.
- .058 Material Dealer's Associations.
- .059 Insurance.

690.1 EDUCATION OF PERSONNEL CONCERNED IN BUILDING.

- .11 Education of Designers.
- .12 Education of Supervisors.
- .13 Education of Managers.
- .14 Education of Craftsmen.

690.2 BUILDING MATERIAL IN THE ABSTRACT.

(All special material should be classified under the appropriate trade.)

690.3 PLANS FOR BUILDINGS.

.30 Incidents to the Preparation of Drawings.

- .301 Drafting Room Supplies.
- .302 Drafting Methods.
- .303 Cost Accounting.
- .31 Preliminary Studies.
- .32 General Drawings.
- .33 Scale Details.
- .34 Full Size Details.

690.4 SPECIFICATIONS FOR BUILDINGS.

- .40 Matter Pertaining to All Trades.
- .40-A General Conditions of the Contract
- .40-B Form of Agreement.
- .40-C Form of Bid.

- .40-D Form of Advertisement.
- .40-E Form of Invitation to Bid.
- .41 Earth Working and Transportation Trades.** (See File 691.)
- .41-A Preparation of Site.
- .41-B Wrecking.
- .41-C Shoring and House Moving.
- .41-D Excavating.
- .41-E Caisson and Special Foundations.
- .41-F Construction Plan.
- .41-G Maintenance Contract.
- .41-I Grading and Filling.
- .41-J Preparation of Soil, Sodding and Seeding.
- .41-K Planting.
- .41-Z Miscellaneous Labor not Otherwise Classified.
- .42 Mortar Using Trades.** (See File 692.)
- .42-A Masonry Materials.
- .42-B Foundation Work.
- .42-C Concrete Work.
- .42-D Stone Work.
- .42-E Brick Work.
- .42-F Fireproofing, Furring and Partitions.
- .42-G Architectural Terra Cotta.
- .42-H Paving.
- .42-I Smoke Stacks of Masonry.
- .42-J Plastic Reinforcement, Lathing and Furring.
- .42-K Plastering.
- .42-L Models, Clay and Plaster.
- .42-M Plastic Insulation, Pipe Covering, Etc.
- .42-N Marble and Substitutes (Including Slate, Structural Glass Terrazzo-Slabs, Etc.)
- .42-O Tile and Substitutes.
- .42-P Terrazzo Blocks.
- .42-Z Miscellaneous Mortar Using Trades not Classified.

690.43 Wood-Working Trades and Hardware. (See File 693.)

- .43-A Wood-Working Materials and Methods.
- .43-B Carpentry.
- .43-C Rough Carpentry Hardware.
- .43-D Finish Hardware.
- .43-E Revolving Doors.
- .43-F Special Doors, Folding, Rolling, Etc.
- .43-G Screens, Wood Frame, for Insects.
- .43-H Wood Registers, Screens, Etc.
- .43-I Mantels, Etc., of Wood.
- .43-J Wood Specialties Show-Cases, Cabinets, Etc.
- .43-K Seating for Assembly Pews, Opera Chairs, Etc.
- .43-L Wood Platform Furniture, Pulpits, Lectern Sedilia, Altars, and Altar Furniture.
- .43-M Portable Furniture of Wood, Chairs, Etc.
- .43-N Domestic Furniture.
- .43-Z Miscellaneous Woodworking Trades not Otherwise Classified.

690.44 Heavy Metal Trades (employing metal heavier than No. 10 gauge). (See File 694.)

- .44-A Metal Materials and Methods.
- .44-B Structural Metal (over No. 10 gauge).
- .44-C Miscellaneous Metal.
- .44-D Ornamental Metal (over No. 10 gauge).
- .44-E Vaults, Safes, Vault Doors, Etc.
- .44-F Solid Metal Sash.
- .44-G Heavy Metal Doors and Shutters.
- .44-H Fire Escapes.
- .44-I Stairs, Metal.
- .44-J Fences, Metal.
- .44-Z Miscellaneous Heavy Metal Trades not Otherwise Classified.

690.45 Sheet Metal Trades (employing metal of No. 10 gauge or less. See File 695.)

- .45-A Sheet-Metal Materials and Methods.
- .45-B Ordinary Sheet-Metal.
- .45-C Slate and Tile Roofing.

- .45-D Ventilating Ducts, Fans, Stacks and Furnaces, Etc.
- .45-E Hollow Metal Windows.
- .45-F Metal Clad Wood Doors.
- .45-G Enamel Sheet-metal Ceilings.
- .45-H Art Sheet-metal Trim and Doors.
- .45-I Enamel Sheet-metal Cabinets.
- .45-J Enamel Sheet-metal Lockers.
- .45-K Enamel Sheet-metal Radiator Covers and Seats.
- .45-L Enamel Sheet-metal Toilet Partitions.
- .45-M Metal Furniture.
- .45-N Sheet-metal Utensils.
- .45-O Drawn Sheet Metal Store Fronts, Etc.
- .45-Z Miscellaneous Sheet Metal Trades not Otherwise Classified.

690.46 Brush, Broom and Swab-Using Trades (See File 696.)

- .46-A Brush Trade Materials and Methods.
- .46-B Water-proofing Membrane and Mastic or other Viscous Compositions mopped, broomed or swabbed in place.
- .46-C Composition Roofing.
- .46-D Plain Painting and Varnishing.
- .46-E Decorations (Plain, Painted or Water Color).
- .46-F Hangings, Fabrics, etc.
- .46-G Upholstery.
- .46-H Window Shades.
- .46-I Mastic Tile and Sheet Floor Covering.
- .46-J Rubber Tile and Sheet Floor Covering.
- .46-K Cork Tile and Sheet Floor Covering.
- .46-L Carpets, Linoleums, Etc., Floor Covering.
- .46-M Plain Glass and Glazing.
- .46-N Art Glass and Glazing.
- .46-Z Miscellaneous Brush Trades not Otherwise Classified.

690.47 Pipe Trades. (See File 697.)

- .47-A Pipe Trades Materials and Methods.
- .47-B Sanitary Plant.**
- .47-B-1 Sewerage and Drainage.
- .47-B-2 Sewerage and Bilge Pumps.
- .47-B-3 Sewerage Disposal.
- .47-B-4 Plumbing.
- .47-B-5 Tanks and Towers for Water Supply, Stand Pipes.
- .47-B-6 Gas Fitting.
- .47-B-7 Gas Stoves, Etc.
- .47-C Sprinkler Fitting.**
- .47-C-1 Storage Tanks and Towers.
- .47-C-2 Pressure Tanks, Etc.
- .47-C-3 Pumps.
- .47-D Boiler Plant.**
- .47-D-1 Steel Stacks and Breeching.
- .47-D-2 Tanks for Water Storage.
- .47-D-3 Tanks for Oil Storage.
- .47-D-4 Super Steam Heaters.
- .47-D-5 Tube Blowers.
- .47-D-6 Tube Cleaners.
- .47-D-7 Furnaces.
- .47-D-8 Stokers.
- .47-D-9 Coal Handling Equipment.
- .47-D-10 Ash Handling Equipment.
- .47-D-11 Pulverized Coal Burners and Pulverizers.
- .47-D-12 Oil Burners.
- .47-D-13 Gas Burners.
- .47-D-14 Draft Inducer Blowers.
- .47-D-15 Soot Burners.
- .47-D-16 Fuel Economizers.
- .47-D-17 Smoke Indicators.
- .47-D-18 Feed Water Heaters.
- .47-D-19 Boiler Feed Pumps.
- .47-D-20 Service Pumps.
- .47-D-21 Fire Pumps.
- .47-D-22 Governors for Pumps, Etc.
- .47-D-23 Water Softeners.
- .47-D-24 Lubricators.
- .47-D-25 Injectors for Compound.
- .47-D-26 Injectors for Water.
- .47-D-27 Feed Water Regulators.
- .47-D-28 Draft Regulators.
- .47-D-29 Flow Meters.

- .47-D-30 Draught Gauges.
- .47-D-31 CO₂ Recorders.
- .47-E Steam and Hot Water Fitting.
- .47-E-1 Vacuum Pumps.
- .47-E-2 Vacuum Valves.
- .47-E-3 Miscellaneous Specialties.
- .47-F Steam Power Plant.
- .47-F-1 Engines.
- .47-F-2 Compressors.
- .47-G Vacuum Cleaning Plant.
- .47-H Mechanical Refrigeration.
- .47-H-1 Tanks.
- .47-H-2 Compressors.
- .47-H-3 Cooler Towers.
- .47-I Mechanical Ventilation.
- .47-I-1 Heating Units.
- .47-I-2 Cooling Units.
- .47-I-3 Air Washers.
- .47-I-4 Fans and Engines.
- .47-Z Miscellaneous Pipe Trades not Otherwise Classified.
- 690.48 Wire and Conduit Trades (See File 698).
- .48-A Wire Trades Materials and Methods.
- .48-B Electrical Conduit and Wiring.
- .48-C Lighting Fixtures.
- .48-D Electrical Power Work.
- .48-E Electric Signs.
- .48-F Private Telephone System.
- .48-G Clock System.
- .48-H Signal Clock System.
- .48-I Fire Alarm System.
- .48-J Burglar Alarm System.
- .48-K Projecting Machines.
- .48-Z Miscellaneous Electrical Trades not Otherwise Classified.
- 690.49 Machinery and Miscellaneous Trades (See File 699).
- .49-A Machinery and Miscellaneous Materials and Methods.
- .49-B Elevators.
- .49-B-1 Passenger Elevators.
- .49-B-2 Freight Elevators.
- .49-B-3 Dumbwaiters.
- .49-C Conveying Machines.
- .49-D Mechanical Cleaners.
- .49-E General Machinery.
- .49-F Foundry Equipment.
- .49-G Insulation, Pipe Covering, Etc. (See File 690.42-M).
- .49-H Refrigerators, Coolers and Freezers.
- .49-H-1 Ice Boxes.
- .49-H-2 Electric Refrigeration.
- .49-H-3 Gas Refrigeration.
- .49-I Laundry Equipment.
- .49-J Kitchen Equipment.
- .49-K Laboratory Equipment.
- .49-L Gymnasium Equipment.
- .49-Z Miscellaneous Equipment not Otherwise Classified.
- 690.5 ESTIMATES FOR BUILDINGS.
- .5-A Cube System.
- .5-B Area System.
- .5-C By Trades.
- .5-D By Quantity Survey.
- 690.6 CONTRACTS AND GENERAL CONDITIONS.
- 690.7 SUPERVISION OF CONSTRUCTION AND ACCOUNTS.
- 690.8 PROFESSIONAL SERVICES.
- .80-A Remuneration, Fees, Commissions.
- .80-B Duties, Relationships, Etc.
- .80-C Responsibility, Etc.
- .80-D License or Registration.
- .81 Architect.
- .82 Structural Engineer.
- .83 Mechanical Engineer.
- .84 Sanitary Engineer and Surveyors.
- .85 Electrical Engineer.
- .86 Illuminating Engineer.
- .87 Clerk of the Works, Draftsmen, Stenographers and Employees.
- .88 Building Construction Manager.
- .89 Specialists not otherwise Classified.
- 690.9 LAWS AND RULES CONTROLLING BUILDING.
- .91 State or General Laws.
- .92 Municipal Ordinances, Rules, Etc.
- .93 Trade Rules.

- .94 Findings, National Joint Board of Jurisdictional Awards.
- .95 Lien Laws.
- .96 Underwriters' Rules.
- .97 Public Service Company's Rules.
- .98 Liabilities of:
- .981 Architects.
- .982 Contractor.
- .983 Workman.
- .984 Owner.
- .985 Bondsman.
- .986 Liability Insurance Co.
- .987 Adjoining Property Owner.
- .988 Public.
- .989 Any Other Responsibilities.
- 691 EARTH-WORKING, TRANSPORTATION AND TEAMING TRADES.
- 691.0 TOOLS, UTENSILS, APPARATUS, ETC.
- .01 Shovels, Picks, Drills, Bars, Wheelbarrows, Etc.
- .02 Plows, Scrapers, Trucks, Carts, Wagons, Teams, Tractors.
- .03 Excavating, Trench and Mining Machinery.
- .04 Hoists, Cranes, Pile Drivers, Conveyors, Hoisting Engines, Etc.
- .05 Dummy Railroad Equipment, Trucks, Cars, Etc.
- .06 Soil Testing Apparatus.
- .07 Shoring, Sheet Piling, Piling, Caissons, Scaffolding, Etc.
- .071 Wood.
- .072 Metal.
- .073 Concrete.
- .08 Blasting Powder and Apparatus.
- .09 Rock Crushers.
- 691.1 MATERIALS TO BE REMOVED.
- .11 Common Earth, Clay, Sand, Gravel, Hard-pan, Conglomerate Rock, Etc.
- .12 Trees, Shrubs, Etc.
- .13 Rubbish, Etc.
- .14 Buildings, Vaults, Pipes, Cisterns, Etc.
- 691.2 DISPOSAL OF MATERIALS.
- .21 Stacking.
- .22 Cartage.
- .23 Dumps.
- 691.3 UTILIZATION OF MATERIALS.
- .31 Sand and Gravel Stored for Mortar.
- .32 Black Earth for Top Fill.
- .33 Crushed Rock for Aggregate.
- .34 Cleaning and Stacking Building Material for Use in New Building.
- .35 Re-Planting and Protection of Trees and Shrubs.
- 691.4 FILLING & GRADING MATERIAL.
- .5 FERTILIZER, SOIL TREATMENT.
- .6 NURSERY STOCK, SODDING AND SEEDING.
- .7 DRAINAGE MATERIAL.
- .8 FROST PROTECTION.
- .9
- 692 MORTAR-USING TRADES — (Inc. Masonry, Plastering, Tile and Marble Setting and the preparation for same).
- 692.0 MASONRY APPARATUS.
- .01 Mixing Boxes, Platforms, Etc.
- .02 Tools, Hose, Heaters, Etc.
- .03 Mixers for Mortar and Concrete.
- .04 Scaffolding, Horses, Planks, Etc.
- .05 Forms.
- .06 Erection Apparatus, Hoists, Cranes, etc.
- .07 Shutes and Conveyors.
- 692.1 MATERIALS FOR MASONRY.
- .11 Liquids, Water, Anti-freezing, Etc.
- .12 Aggregate (a) Sand, (b) Stone Screenings, (c) Gravel, (d) Crushed Stone, (e) Crushed Slag, (f) Cinders, (g) Haydite, Etc.

- .13 **Cementing Materials for Masonry.**
- .131 Limes.
- .132 Hydraulic Cements, (a) Natural, (b) Portland, (c) Miscellaneous.
- .133 Gypsums, (a) Plaster of Paris, (b) Keene's Cement, (c) Miscellaneous.
- .134 Magnesites.
- .135 Asphaltic Cements.
- .136 Composite Cements.
- .137 Other Cements, Unclassified.
- .138 Mortar Color.
- .14 **Solids for Masonry.**
- .141 Stone.
- .142 Brick, (a) Adobe, (b) Burned Clay, (c) Sand Lime.
- .143 Structural Partition and Load-bearing Tile.
- .144 Terra Cotta, (a) Coping, (b) Ornamental Flue Lining, etc.
- .145 Cement Blocks.
- .146 Composite Blocks.
- .147 Marble, Soapstone, Structural Slate and Glass Substitutes.
- .148 Tile, Paving and Wall.
- .149 Terrazzo Blocks and Slabs.
- .15 **Mason's Hardware.**
- .151 Anchors, Ties, Wall Boxes, Plates, Inserts, Scoopers, Sleeves, Etc.
- .152 Thimbles, Ash and Coal Chutes, Clean-out Doors, Dampers, Grate Bars, Chimney Cap, Vent Gratings, Etc.
- .153 Vault Lights, Sidewalk Doors, Etc.
- .154 Screeds, Metal Expansion Joints.
- .16 **Reinforcing for Masonry.**
- .161 Bar Reinforcement.
- .162 Fabric.
- .163 Metal Lath.
- .164 Wood-lath, Plaster Board.
- .165 Fiber, Hair, etc.
- 692.2 **STONE CONSTRUCTION.**
- .21 Preservatives Treatment.
- .22 Bond, Anchorage, Ties, Lewises, Etc.
- .23 Cutting and Dressing of Stone, Stereotomy, Drips, Weathering, Etc.
- .24 Setting, Joints, Mortar, Bedding, Etc.
- .25 Cleaning and Pointing.
- 692.3 **BRICK CONSTRUCTION.**
- .31 Preservative Treatment.
- .32 Common Brick Work.
- .33 Fire Brick Work.
- .34 Face Brick Work.
- .35 Laying Joints, Mortar, Etc.
- .36 Chases, Fire-Stops, Corbels, Etc.
- .37 Bonds, Anchors, Etc.
- .38 Cleaning and Pointing, Etc.
- .39 Special Brick Work.
- 692.4 **TERRA COTTA CONSTRUCTION.**
- .41 Preservative Construction.
- .42 Bonding, Anchorage, Ties, Etc.
- .43 Structural Tile Walls.
- .44 Structural Tile Floors.
- .45 Ornamental or Decorative Terra Cotta.
- .46 Laying Joints, Mortar, Etc.
- .47 Fitting Around Structural Parts.
- .48 Centers, Supports, Protection.
- .49 Cleaning, Pointing and Repairing.
- .5 **FIREPROOF CONSTRUCTION.**
- .51 Hollow Clay Tile, (a) Hard, (b) Porous.
- .52 Gypsum Tile.
- .53 Concrete.
- .54 Tying, Fitting, Securing.
- .55 Combination Construction.
- .56 Centers, Forms, Etc. (See 693.41 for Wood and 695 for Sheet-Metal.)
- .59 Patching, Repairing.
- 692.6 **CONCRETE CONSTRUCTION.**
- .61 Massive, Caissons, Footings, Retaining Walls, Etc.
- .62 High Duty Concrete.
- .63 Hollow Concrete Building Blocks.
- .64 Ornamental Concrete.
- .65 Concrete Supported on the Ground, Paving of Walks, Floors, Drives, Etc.
- .66 Waterproof Concrete.
- .67 Reinforced Concrete.

- .671 Reinforcing Systems, Arranged Alphabetically.
- .672 Forms and Centers. (See 693.41 for Wood; also 695 for Sheet-Metal.)
- .673 Tests and Inspection.
- .674 Data for Experiments.
- .675 Formulae, (a) Vault Construction.
- .676 Special Applications.
- 692.7 **DECORATIVE AND SANITARY WALL AND FLOOR SURFACING.**
- .71 Marble, Soapstone and Slate.
- .72 Structural Glass.
- .73 Terrazzo.
- .74 Tile Mosaic, (a) Ceramic, (b) Marble, (c) Glass.
- .75 Tile, (a) Quarry, (b) Encaustic, (c) Marble, (e) Ornamental, (f) Composition Non-Slip, (g) Slate Flagging, (h) Rubber Tile.
- .76 Sanitary Composition Floors.
- 692.8 **WATER-PROOFING AND HARDENERS.**
- .81 Integral Waterproofing (for brush applied mastic and painting, waterproofing, see File 696).
- .82 Hardeners (a) Surface, (b) Admixed.
- .83 Mortar Colors, Workability Mixtures.
- 692.9 **PLASTER TRADES.**
- .91 Interior Plaster.
- .91(a) Common Lime Plaster.
- .91(b) Gypsum Plaster.
- .91(c) Magnesite.
- .91(d) Portland Cement Plaster.
- .91(e) Lathing.
- .91(f) Special Plasters.
- .92 Exterior Plaster.
- .93 Modeling and Ornamental Plaster.
- 693 **WOOD WORKING TRADES.**
- .0 **APPARATUS, INCIDENTAL TOOLS, ETC.**
- .01 Mechanic's Tools.
- .02 Wood-working Power Machinery, (a) Saws, (b) Planers, (c) Stickers, (d) Sand-papering Machines, (e) Scraping Machines.
- .03 Kilns, Dryers.
- .04 Scaffolding, Ladders, Horses and Benches.
- 693.1 **MATERIALS.**
- .11 Lumber.
- .111 Timber, larger than 6"x6".
- .112 Common Lumber.
- .112 (a) Boards, Furring and Grounds.
- .112 (b) Piece Stuff, Joists and Scantling.
- .112 (c) Shingles, Wood and Composition.
- .113 Finish Lumber.
- .113 (a) Hardwood.
- .113 (b) Soft Wood.
- .113 (c) Flooring.
- .114 Mill Stock.
- .115 Veneers.
- .116 Composition.
- .117 Insulation Papers and Felts.
- .12 Glues.
- .13 Rough Hardware.
- .131 (a) Nails, (b) Spikes, (c) Brads, (d) Hangers, Track, Etc.
- .132 (a) Bolts, (b) Rods, (c) Anchors, Ties, (d) Screws, Etc.
- .133 Rivets.
- .134 (a) Washers, (b) Flitch Plates, (c) Splice Plates.
- .135 Mill Construction Hardware, (a) Stirrups, (b) Hanger, (c) Column Caps, (d) Ties, (e) Box and Wall Anchors, (f) Bearing Plates, Etc.
- .136 Double Hung Sash Hardware, (a) Pulleys, (b) Cords, (c) Chain, (d) Weights, (e) Spring Balances.
- .137 Window Cleaning Hardware.
- .138 **Finish Hardware.**
- .14 Hanging Hardware, (a) Butts, (b) Hinges, (c) Pivots, Etc.
- .141

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- .142 Controlling Hardware, (a) Bumpers, (b) Strikes, (c) Holders, (d) Hooks, (e) Stays, (f) Adjusters, Etc.
 - .143 Fastening Hardware, (a) Old Fashion Latches, (b) Spring Latches, (c) Catches, (d) Fasts, (e) Thumb Bolts, (f) Locks, Etc.
 - .144 Trimming Hardware, (a) Pulls, (b) Knobs, (c) Spindles, (d) Roses, (e) Escutcheons.
 - .145 Protection Hardware, (a) Kick Plates, (b) Push Plates, (c) Direction Plates or Signs, (d) Push Bars, Etc.
 - .146 Operating Hardware, (a) Closers and Checks, (b) Springs, (c) Weights and Pulleys, (d) Window Poles, Etc.
 - .147 Weathering Hardware, (a) Weather Strips, (b) Thresholds, (c) Special Drips, (d) Metal Astrigals, (e) Casement Operators, Etc.
 - .148 Automatic and Panic Hardware.
 - .149 Miscellaneous Hardware not otherwise classified, (a) Wardrobe Hardware, (b) Showcase Hardware, (c) Toilet-room Hardware, (d) Ladder Hardware, (e) Castors, (f) Cabinet Hardware, (g) Gymnasium Apparatus, (h) Mail Boxes and Chutes, (i) Clothes Chutes.
- 693.2 **ORDINARY CONSTRUCTION.**
- .21 Balloon Construction for Frame Buildings.
 - .22 Joist Construction for Masonry Buildings.
 - .23 Trusses, etc.
- 693.3 **HEAVY TIMBER CONSTRUCTION.**
- .31 Heavy Post and Timber Construction for Frame Buildings.
 - .32 Mill Construction for Masonry Buildings.
- 693.4 **AUXILIARY WOOD CONSTRUCTION FOR FIREPROOF BUILDINGS.**
- .41 Centers, Forms, Protective Covering, Scaffolding, Etc.
 - .42 Grounds, Attachment Strips, Etc.
- 693.5 **JOINERY AND MILL WORK.**
- .51 Frames and Sash.
 - .511 Box Frames, Double Hung Sash.
 - .512 Casement Frames, Sash Opening In.
 - .513 Casement Frames, Sash Opening Out.
 - .514 Frames for Sash Hinged at Bottom. Swinging In at Top.
 - .515 Frames for Sash Hinged at Top, Swinging In at Bottom.
 - .516 Frames for Sash Hinged at Top, Swinging Out at Bottom.
 - .517 Frames for Horizontal Pivoted Sash.
 - .518 Frames for Vertical Pivoted Sash.
 - .52 Wood Interior Trim.
 - .53 Wood Floors.
 - .54 Blinds.
 - .55 Doors.
 - .551 Ordinary Panel and Sanitary Doors.
 - .552 Special Revolving Doors.
 - .553 Folding, Accordion Doors.
 - .554 Rolling Doors.
 - .56 Screens.
- 693.57 Mouldings.
- 693.58 Flooring Wood.
- .59 Columns.
- 693.6 **STAIR BUILDING.**
- 693.7 **ORNAMENTAL JOINERY.**
- .71 CABINET WORK, (a) Mantels, (b) Sideboards, (c) Cases, (d) Space Savers, (e) Panel Partitions.
- .72 **WOOD FURNITURE.**
- 693.8 **WOOD CARVING, WOOD LETTERS.**
- .9 **MISCELLANEOUS.**
- 694 **HEAVY METAL TRADES — (Employing Metal heavier than No. 10 gauge).**
- .0 **TOOLS, UTENSILS, APPARATUS, ETC.**
- 694
- .01 **Job Machinery.**
 - .02 **Job Tools, Hammers, Sledges, Punches, Tongs, Reamers, Riveters, Forges, Etc.**
 - .03 **Derricks, Cable, Hoisting Machinery.**
 - .1 **MATERIALS USED IN THE METAL TRADES.**
 - .11 **Iron Products.**
 - .111 Cast-Iron.
 - .112 Wrought Iron.
 - .113 Steel.
 - .114 Alloys, (a) Copper Bearing Steel, (b) Nickel Steel, (c) Sheradized Steel.
 - .12 **Copper.**
 - .13 **Brass.**
 - .14 **Bronze.**
 - .15 **Aluminum.**
 - .16 **Miscellaneous Structural Metals.**
- 694.2 **STRUCTURAL METAL CONSTRUCTION.**
- .21 **Fabrication.**
 - .211 Shop Drawings.
 - .22 **Framing.**
 - .221 Bases, Bearing Plates, Etc.
 - .222 Columns and Struts.
 - .223 Caps, Connections, Gussets, Etc.
 - .224 Girders, Beams, Etc.
 - .225 Suspenders, Tie-Rods, Chains Etc
 - .23 **Preservatives.**
 - .231 Paint. (See 696.)
 - .232 Galvanizing.
 - .233 Other Methods.
- 694.3 **MISCELLANEOUS METAL.**
- .31 **Fire Escapes.**
 - .32
 - .33
- 694.4 **HEAVY METAL DOORS, SHUTTERS, ETC.**
- .41 Underwriters' Doors.
 - .42 Sidewalk Doors, Floor Plates.
 - .43 Shutters.
- 694.5 **ORNAMENTAL METAL.**
- .51 Stairs, Thresholds.
 - .52 Enclosures, Guards, Grills, Fences, Gates, Flag Poles, Etc.
 - .53 Elevator Enclosures and Cages.
 - .54 Fireplace Trimming.
 - .541 Andirons, Tongs, Pokers, Spark-screens, etc.
 - .542 Grate Frames, Dampers, Grates, Etc.
 - .543 Furniture.
- 694.6 **SOLID METAL SASH.**
- 694.7 **VAULT DOORS, SAFES, VAULTS, ETC.**
- .71 Vault Doors.
 - .72 Safes.
 - .73 Vaults and Bank Equipment.
- 694.8 **Tablets Memorials, Signs, Bulletins, Etc.**
- .9 Bells and Miscellaneous.
- 695 **SHEET-METAL TRADES — (Employing Metal of No. 10 gauge or less).**
- 695.0 **TOOLS, UTENSILS AND APPARATUS (used by the Sheet-Metal Trades).**
- .01 Brakes, Shears, Mallets, Hammers Etc.
 - .02 Welding Machines.
 - .03 Soldering Apparatus.
 - .04 Plating Apparatus.
- 695.1 **SHEET-METAL MATERIALS.**
- .11 Sheet Iron.
 - .111 Tin or Tin Coated Sheet Iron.
 - .112 Galvanized Iron.
 - .12 Sheet Copper.
 - .121 Planished Copper.
 - .13 Zinc Sheet.
 - .14 Brass Sheet.
 - .15 Bronze Sheets.
 - .16 Other Sheet Metals.
 - .17 Solders, Fluxes, Etc.
 - .18 Hardware.
 - .181 Rivets and Bolts.

- 695
 .182 Nails, Tacks and Screws.
 .183 Incidental Hardware.
 .19 Miscellaneous.
 695.2 **ORDINARY SHEET-METAL CONSTRUCTION.**
 .21 **Roofs.**
 .211 Tin.
 .212 Galvanized Iron.
 .213 Copper.
 .214 Slate Shingles.
 .215 Composition.
 .216 Tile Shingles.
 .217 Cement Tile.
 .22 Cornices, Etc.
 .23 Flashing, Gutters, Valleys, Down-Spouts and Conductor Heads, Roofing, Etc.
 .24 Sky-lights, Ventilator Heads, Etc.
 .251 Furnace Work, Casings, Ducts and Stacks, Etc.
 .252 Ventilation Ducts.
 .253 Chutes, Etc.
 695.3 **FIRE RESISTING DOORS AND WINDOWS.**
 .31 Underwriters' Tin-Clad Doors.
 .32 Underwriters Sheet-Metal Sash.
 .33 Rolling Steel Shutters and Doors.
 695.4 **CEILINGS, STAMPED SHEET-METAL.**
 695.5 **DRAWN SHEET-METAL.**
 .51 Store Front Bars.
 .52 Showcase Bars, Etc.
 .53 Copper Casements.
 695.6 **TRIM AND DOORS OF SHEET METAL.**
 695.7 **FURNITURE OF SHEET METAL.**
 695.8 **UTENSILS OF SHEET METAL.**
 695.9 Steel Joists, Forms, Etc.
 696 **BRUSH, BROOM AND SWAB-USING TRADES.**
 .0 **BRUSH TRADE, TOOLS AND APPARATUS.**
 .01 Kettles, Buckets, Ladles, Swabs and Other Roofers' and Waterproofers' Tools.
 .02 Brushes, Cans, Knives, Etc.
 .03 Ladders, Scaffolding, Hoists, Etc.
 .04 Drop Cloths.
 .05 Grinders.
 .06 Spraying Machines.
 696.1 **BRUSH TRADE MATERIALS AND METHODS.**
 .11 Roofing and Waterproofing Materials.
 .111 Felt.
 .112 Paper.
 .113 Gravel, Slag, Crushed Stone, Paving Tile, Etc.
 .114 Tar and Asphalt.
 .115 Creosote, Dips and Stains.
 .12 Painters' Materials.
 .121 Binders, (a) Oil, (b) Casein, (c) Dryers.
 .122 Pigments, (a) White Lead, (b) Red Lead, (c) Zinc, (d) Graphite, (e) Whiting, (f) Lime, (g) Other Pigments.
 .123 Colors, (a) Vegetable, (b) Mineral.
 .124 Solvents, (a) Turpentine, (b) Benzine, (c) Alcohol, (d) Other Solvents.
 .125 Wood Finishing Materials, (a) Stains, (b) Fillers, (c) Shellacs, (d) Varnishes, (e) Enamels, (f) Waxes, (g) Other Materials, (h) Lacquers.
 .126 Prepared Paints.
 .13 Water Paints.
 .131 Binder, (a) Casein, (b) Glue, (c) Other Binders.
 .132 Pigments, (a) Lime, (b) China Clay, (c) Whiting.
 .133 Colors.
 .14 Wall Papers.
 .15 Hangings and Coverings.
 .151 Fabrics.
 .152 Leather, (a) Genuine, (b) Imitation.
 .16 Hanging Hardware Poles, Etc.
 .17 Upholstery, (a) Tacks, (b) Feathers, (c) Hair, (d) Moss, (e) Ticking, (f) Cord, (g) Other Materials.
- 696
 .18 **Glazing Material.**
 .181 Glass, (a) Common Glass, (b) Plate Glass, (c) Ornamental Glass, (d) Wire-glass, (e) Prismatic Glass, (f) Colored Glass, (g) Glass Substitutes.
 .182 Putties.
 .183 Tacks.
 .184 Leading Bars, (a) Lead, (b) Zinc (c) Copper, (d) Ventilators.
 .19 **Other Materials.**
 696.2 **WATER-PROOFING WORK.**
 .21 Brushed on Construction.
 .22 Membrane.
 .23 Calking.
 696.3 **COMPOSITION ROOFING WORK**
 .31 Tar and Gravel Roofing.
 .32 Asphaltum Composition Roofing.
 .33 Promenade Deck Roofing.
 .34 Mastic Floors.
 .35 Composition Flashing.
 696.4 **PAINTING WORK.**
 .5 **WOOD FINISHING WORK.**
 .6 **GENERAL DECORATIONS.**
 .61 Ordinary Water Color Tinting.
 .62 Fresco Painting, Stenciling, Etc.
 .63 Mural Decorations.
 .7 **UPHOLSTERY.**
 .8 **HANGINGS.**
 .81 Ordinary Window Shades, Awnings.
 696.82 **Lace Curtains.**
 .83 Draperies, Decorative Screens, Etc.
 .84 Carpets, Rugs and Linoleums, Rubber Tile.
 .85 Tents.
 696.9 **GLAZING.**
 .91 Common Glazing.
 .92 Art Glass Glazing.
 697 **PIPE TRADES.**
 .0 **TOOLS, UTENSILS AND APPARATUS.**
 .01 Mechanic's Chest Tools, Furnaces, Etc.
 .02 Power Pipe Cutter, Benders, Dies, Etc.
 .03 Scaffolding Ladders, Etc.
 697.1 **MATERIALS.**
 .11 Metals, (a) Wrought Iron, (b) Steel, (c) Lead, (d) Brass, (e) White Metal.
 .12 **Pipe.**
 .121 Wrought Iron, (a) Black, (b) Galvanized.
 .122 Steel, (a) Black, (b) Galvanized.
 .123 Cast Iron, Duriron.
 .124 Brass, Bronze and Copper.
 .125 White Metal.
 .126 Block Tin.
 .127 Lead Lined Iron.
 .128 Tin Lined Iron.
 .129 Tile Pipe.
 .13 **Pipe Fittings.**
 .131 Screw Connections.
 .132 Flange Connections.
 .133 Union Connections, Expansion Joints.
 .134 Caulked Connections.
 .135 Valves, (a) Shut-off, (b) Gate, (c) Disk, (d) Other Valves, (e) Air Vents.
 .136 Pipe Hangers, Supports, Etc.
 .137 Under-Ground Conduit.
 .14 **Tanks.**
 .141 Hot Water.
 .142 Cold Water, (a) Wood, (b) Metal.
 .143 Oil Tanks.
 .144 Gas Tanks.
 .15 **Boiler.**
 .151 Steel Water Tube.
 .152 Steel Flue Tube.
 .153 Cast Iron Sectional.
 .16 **Stoves.**
 .161 Coal.
 .162 Gas.
 .163 Oil.

- 697
 .17 **Furnaces, Grates and Stokers for Coal and Oil.** (a) Ordinary, (b) Smokeless, (c) Dutch-oven, (d) Oil Burning, (e) Mechanical Feed.
 .18 **Brass Goods.**
 .19 **Pottery.**
 697.2 **SEWERAGE, and Drainage** (See 692 for Masonry Sewers.)
 697.21 **Drainage.**
 .22 **Sewerage.**
 .23 **Sewerage and Bilge Pumps.**
 .24 **Sewerage Disposal Equipment.**
 .3 **PLUMBING TRADE.**
 697.31 **Plumbing Fixtures.**
 .311 **Roughing-in,** (a) Durham System, (b) Cast-Iron Caulked Joint System.
 .312 **Water Supply,** (a) Pumps, (b) Tanks, (c) Hose and Fire Apparatus, (d) Filters, (e) Sterilizers, (f) Ice Machinery, (g) Stills, Etc. (h) Domestic Heater, (i) Softeners, (j) Meters.
 .313 **Garbage and Sewage Disposal,** (a) Bilge Pumps, Incinerators.
 .314 **Fixtures for Plumbing,** (a) Floor Drains, (b) Cesspools, (c) Sinks, (d) Slop Sinks, (e) Laundry Wash Trays, (f) Lavatories, (g) Bath-tubs, (h) Showers, (i) Water Closets, (j) Urinals, (k) Bath and Toilet Room Trimmings, Paper-Holders, Towel Racks, Tumbler Holders, Soap Dishes, Etc.
 .315 **Laundry Machinery.**
 .316 **Kitchen Machinery.**
 697.4 **GAS FITTING.**
 .41 **Meters.**
 .42 **Fixtures.**
 .43 **Gas-water Heaters.**
 .44 **Clothes Dryers.**
 .45 **Gas Stoves.**
 697.5 **MECHANICAL CLEANING.**
 .6 **SPRINKLER FITTING.**
 .60 **Erecting Apparatus.**
 .61 **Sprinkler-fitting Devices.**
 .62 **Storage Tanks and Towers.**
 .63 **Pressure Tanks, etc.**
 .64 **Sprinkler Equipment Pumps.**
 .7 **HEATING, STEAM AND HOT WATER AND VENTILATION.**
 .71 **One-Pipe Gravity.**
 .72 **Two-Pipe Gravity.**
 .73 **Vapor Two-Pipe.** (Systems arranged alphabetically.)
 .74 **Vacuum.** (Systems arranged alphabetically.)
 .75 **Radiation,** (a) Direct, (b) Direct-Indirect, (c) Indirect, (d) Hangers.
 .76 **Boiler Plant.**
 .76-1 **Steel Stacks and Breeching.**
 .76-2 **Tanks for Water Storage.**
 .76-3 **Tanks for Oil Storage.**
 .76-4 **Super Steam Heaters.**
 .76-5 **Tube Blowers.**
 .76-6 **Tube Cleaners.**
 .76-7 **Furnaces.**
 .76-8 **Stokers.**
 .76-9 **Coal Handling Equipment.**
 .76-10 **Ash Handling Equipment.**
 .76-11 **Pulverized Coal Burners and Pulverizers.**
 .76-12 **Oil Burners.**
 .76-13 **Gas Burners.**
 .76-14 **Draft Inducer Blowers.**
 .76-15 **Soot Burners.**
 .76-16 **Fuel Economizers.**
 .76-17 **Smoke Indicators.**
 .76-18 **Feed Water Heaters.**
 .76-19 **Boiler Feed Pumps.**
 .76-20 **Service Pumps.**
 .76-21 **Fire Pumps.**
 .76-22 **Governors for Pumps, Etc.**
 .76-23 **Water Softeners.**
 .76-24 **Lubricators.**
 .76-25 **Injectors for Compound.**
 .76-26 **Injectors for Water.**
 .76-27 **Feed Water Regulators.**
 .76-28 **Draft Regulators.**
 .76-29 **Flow Meters.**
 697
 .76-30 **Draught Gauges.**
 .76-31 **CO₂ Recorders.**
 .77 **Mechanical Refrigeration.**
 .771 **Tanks.**
 .772 **Compressors.**
 .773 **Cooling Towers.**
 .78 **Mechanical Ventilation, Air Washers and Filters.**
 697.8 **STEAM-POWER WORK, PUMPS, ETC.**
 .81 **Engines.**
 .82 **Compression.**
 .83 **Pumps.**
 .9 **OTHER PIPE TRADES.**
 698 **WIRE AND CONDUIT TRADES—Electrical Work of All Kinds.**
 .0 **TOOLS, UTENSILS AND APPARATUS.**
 698.1 **MATERIALS FOR WIRE TRADES**
 .11 **Conduit.**
 .111 **Pipe.**
 .112 **Flexible Greenfield, Etc.**
 .113 **Moulding,** (a) Wood, (b) Metal.
 .114 **Tile and Porcelain.**
 .115 **Knob and Tube Substitute.**
 .12 **Insulation.**
 .13 **Wire,** (a) Gauges, (b) Kinds.
 .14 **Switchboards.** **Miscellaneous Devices.**
 .141 **Switchboards.**
 .142 **Switches, Switch Plates, Etc.**
 .143 **Cut-out Cabinets, Fuses, Etc.**
 .144 **Transformers.**
 .145 **Receptacle Sockets, Plugs.**
 .146 **Door Openers.**
 .147 **Batteries.**
 .148 **Meters, Instruments.**
 .15 **Lighting Fixtures,** (a) Sockets, (b) General Fittings, (c) Pendants, (d) Brackets, (e) Indirect (f) Semi Indirect, (g) Special Reflectors, (h) Signs.
 .16 **Telephones, Speaking Tubes, Bells, Etc.**
 .161 **Private Telephones.**
 .162 **Signal System, Alarms, Etc.**
 .163 **Speaking Tube.**
 .164 **Letter Boxes, Etc.**
 .17 **Motors and Generators.**
 .18 **Lightning Rods.**
 .19 **Miscellaneous,** (a) Stoves, (b) Fans, (c) Time Systems, (d) Door Operators, (e) Electric Fire-Places.
 698.2 **GENERAL HOUSE WIRING FOR ILLUMINATING AND MINOR POWER WORK.**
 698.3 **TELEPHONE WORK.**
 698.4 **ELECTRIC POWER WORK.**
 698.5 **CENTRAL STATION WORK.**
 698.6 **OTHER ELECTRICAL WORK.**
 699 **MACHINERY TRADES AND MISCELLANEOUS BUILDING ITEMS—(Not Otherwise Classified).**
 699.0 **GENERAL MATTERS PERTAINING TO THE PREPARATION AND ERECTION OF MACHINERY.**
 699.1 **MATERIALS.**
 699.2 **ELEVATORS.**
 .21 **Passenger.**
 .22 **Freight.**
 .23 **Dumb Waiters.**
 699.3 **CONVEYING MACHINES.**
 .31 **Belt Conveyors.**
 .32 **Chain Conveyors.**
 .33 **Pneumatic Tube Conveyors.**
 699.4 **FOUNDRY EQUIPMENT.**
 699.5 **GENERAL MACHINERY.**
 699.6 **INSULATION, PIPE COVERING, ETC.** (See 692 for Plastic Pipe Covering.)

- 699.7 **REFRIGERATORS, COOLERS AND FREEZERS.**
699.8 **Kitchen, Laundry, Laboratory Equipment.**
.81 Laundry Equipment.
.82 Kitchen Equipment.
.83 Laboratory Equipment.
.84 Gymnasium Equipment.
- 699.9 **MISCELLANEOUS TRADES NOT OTHERWISE CLASSIFIED. NOT ORGANS, CHIMES.**
- 700 **FINE ARTS.**
701 **PHILOSOPHY. THEORIES. UTILITY. AESTHETICS.**
702 **COMPENDS. OUTLINES.**
703 **DICTIONARIES. CYCLOPEDIAS.**
704 **ESSAYS. LECTURES. ADDRESSES.**
705 **PERIODICALS. MAGAZINES. REVIEWS.**
706 **SOCIETIES. TRANSACTIONS. REPORTS, ETC.**
707 **EDUCATION. STUDY AND TEACHING OF ART.**
708 **ART GALLERIES AND MUSEUMS.**
709 **HISTORY OF ART IN GENERAL.** Divided like 930-999.
710 **LANDSCAPE GARDENING.**
711 **PUBLIC PARKS.**
712 **PRIVATE GROUNDS. LAWNS.**
713 **WALKS. DRIVES. BRIDGES.**
714 **WATER. FOUNTAINS. LAKES.**
715 **TREES. HEDGES. SHRUBS.** See also 634.9, Forestry; 582, Botany.
716 **PLANTS. FLOWERS.**
.1, Plants; .2, Flowers; .3, Conservatories; .4, Window gardens; .5, Ferneries.
717 **ARBORS. SEATS. OUTLOOKS.**
718 **MONUMENTS. MAUSOLEUMS.**
719 **CEMETERIES.** See also 393.1, Earth burial; 614.61, Public health.
- 722 **ANCIENT AND ORIENTAL ARCHITECTURE (Pagan).**
722.0 **PRIMITIVE.**
.04 Europe.
.05 Asia.
.06 Africa.
.07 America.
722.1 **EGYPTIAN (PERIOD DIVISION).**
.11 Ancient and Middle Empire (4000-2000 B. C.)
.12 Shepherd Kings (2000-1600 B. C.)
.13 Theban New Empire (1600-1250 B. C.)
.14 The Decadence (1150-622 B. C.)
.15 Restoration (Saite Period 663-525 B. C.)
.16 Ptolemaic Period (332-30 B. C.)
722.2 **EASTERN ASIATIC.**
.21 Chinese.
.22 Japanese.
.23 Korean.
722.3 **WESTERN ASIATIC.**
.31 Chaldean.
.311 Summerian.
.312 Akkadian.
.32 Assyrian.
.33 Persian.
.331 Ancient.
.332 Sassanian.
.34 Hittite.
.35 Phoenician.
.36 Jewish.
.37 Cypriote.
.38 Lycian.
722.4 **CENTRAL ASIATIC (INDIAN).**
.41 Hindu.
.42 Buddhist.
.43 Jaina.
.44 Dravidian.
.45 Chalukyan.
.46 Burmese.
- 722.5 **ANCIENT AMERICAN.**
.51 Mexico and Central America.
.511 Toltec.
.512 Aztec.
.513 Maya.
.52 South America.
.521 Inca (Peruvian and others).
- 722.6 **PRE-CLASSIC.**
.61 Aegean (Grecian Archipelago)
.611 Cretan or Minoan.
.612 Mycenaean.
.613 Trojan.
.62 Etruscan (Italy).
Classic.
- 722.7 **GREEK.**
.71 Greece.
.711 Archaic.
.712 Periclean.
.713 Hellenistic.
.72 Asia Minor.
.73 Italy.
.74 Sicily.
.75 Africa.
- 722.8 **ROMAN.**
.81 Italy.
.811 Etruscan influence, 493-40 B. C.
.812 Graeco-Roman influence, 212-27 B.
.813 Augustan, 27 B. C.-14 A. D.
.814 Imperial, 14 A. D.-313 A. D.
.82 Greece.
.83 Germany and Austria.
.84 France.
.85 Spain.
.86 Asia.
.87 Africa.
.88 Britain.
(Arbitrary numbers are used to designate Greek and Roman provinces).
- 723 **MEDIAEVAL ARCHITECTURE.**
723.1 **EARLY CHRISTIAN.**
.14 Italy.
.15 Syria.
.16 Egypt and North Africa (Coptic).
723.2 **BYZANTINE.**
.245 Italy.
.247 Russia.
.2495 Greece.
.2496 Constantinople and Vicinity.
.2497 Balkans.
723.3 **MOHAMMEDAN OR SARACENIC.**
.346 Spain (Moorish).
.353 Arabia.
.3539 Syria.
.354 India.
.355 Persia.
.356 Turkey.
.362 Egypt.
.363 North Africa (Moorish).
723.4 **ROMANESQUE.**
.441 Ireland and Scotland (Celtic).
.442 England.
.4421 Saxon.
.4422 Norman.
.443 Germanic Countries (Rhenish).
.444 France.
.4441 Provencal.
.4442 Aquitainian.
.4443 Auvergnat.
.4445 Cluniac or Burgundian.
.4446 Norman.
.445 Italy.
.4451 Lombard.
.4452 Central.
.4453 Siculo-Arabic.
.446 Spain and Portugal (Iberian Peninsula).
.447 Russia.
.448 Scandinavia.
.4481 Norway.
.4482 Sweden.
.4483 Denmark.
.449 Minor Countries.
- 723.5 **GOTHIC.**
.541 Ireland and Scotland.
.542 England.
.5421 Early English, 1175-1307 (13th C.)
.5422 Decorated, 1307-1377 (14th C.)
.5423 Perpendicular, 1377-1485 (15 C.)

723

- .5424 Tudor, 1485-1558 (Early 16th C.) or
 - { Lancet.
 - .5421 { Geometrical (13th and 14th C.)
 - { Curvilinear.
 - .5422 Rectilinear (15th C.)
 - .5423 Tudor (Early 15th C.)
 - .543 Germanic Countries.
 - .544 France.
 - .5441 Primary or Gothique (13th C.)
 - .5442 Secondary or Rayonnant (14th C.)
 - .5443 Tertiary or Flamboyant (15th C.)
 - .545 Italy.
 - .546 Spain and Portugal (Iberian Peninsula).
 - .547 Russia.
 - .548 Scandinavian Countries.
 - .549 Minor Countries.

724 MODERN.

724.1 RENAISSANCE.

- .141 Ireland and Scotland.
- .142 England.
- .1421 Elizabethan.
- .1422 Jacobean.
- .1423 Queen Ann.
- .1424 Georgian.
- .143 Germanic Countries.
- .144 France.
- .1441 Valois Period.
 - { Transition.
 - { Francis I.
 - { Advanced Renaissance.
- .1442 Bourbon.
 - { Henri IV.
 - { Louis XIV.
 - { Rococo.
- .1443 Louis XVI.
- .1444 Empire.
- .145 Italy.
- .1451 Early.
- .1452 High.
- .1453 Baroque.
- .146 Iberian Peninsula (Spain and Portugal).
- .147 Russia.
- .148 Scandinavian Countries.
- .149 Minor Countries.
- .172 Spanish Colonial (Mission Mexico.)
- .1721 California.
- .1722 New Mexico.
- .1723 Arizona.
- .1724 Texas.
- .1725 Florida (Arbitrary numbers given for geographical divisions).
- .173 American Colonial (Including Georgian).
- .1731 English (1607-1720).
- .17311 New England.
- .17312 New York and Middle States.
- .17313 Maryland, Virginia, S. Carolina (Georgian Period).
- .1723 Dutch (1720-1800).
- .17321 New York.
- .17322 Pennsylvania.
- .1733 Swedish.
- .17331 Pennsylvania.
- .17332 New Jersey.
- .1734 French.
- .17341 Canada.
- .17342 Mississippi Valley.

724.2 CLASSIC REVIVAL (Roman and Greek).

- .241 Ireland and Scotland.
- .242 England.
- .243 Germany.
- .244 France.
- .245 Italy.
- .246 Spain.
- .247 Russia.
- .248 Scandinavian Peninsula.
- .249 Minor Countries.
- .271 United States (1800-1850).

The Classic Revival began with the revival of Roman, but in Germany, England and America the Greek Revival eclipsed the Roman. Many public buildings in the United States were built during the Greek Revival.

724.3

GOTHIC REVIVAL.

- .341 Ireland and Scotland, etc.
- .373 United States.
- 724.4 ROMANESQUE REVIVAL.
- .441 Ireland and Scotland, etc.
- .473 United States.
- 724.5 MODERNIST SCHOOL.
- .541 Ireland and Scotland.
- .542 England.
- .543 Germany and Austria (Secession Movement).
- .544 France (Art Nouveau).
- .545 Italy, etc.
- .573 United States (Functionalism).
- .6
- .7
- .8

724.9

CONTEMPORARY TYPES.

- .941 Ireland and Scotland, etc.
- .973 United States.
- .9731 French Renaissance Vogue.
- .9732 Neo-Romanesque Vogue.
- .9733 Neo-Classic Vogue.
- .9734 Neo-Gothic Vogue.
- .9735 Spanish Vogue.
- .9736 Italian Vogue.

DEWEY'S GEOGRAPHICAL TABLE.

These numbers are added to the various styles in order to designate geographical distribution.

- 4 EUROPE.
- 41 Ireland and Scotland.
- 42 England.
- 43 Germany.
- 431 Austria.
- 44 France.
- 45 Italy.
- 46 Spain.
- 47 Russia.
- 48 Scandinavian Countries.
- 49 Minor Countries.
- 5 ASIA.
- 6 AFRICA.
- 7 NORTH AMERICA.
- 71 Canada.
- 72 Mexico.
- 73 United States.

725

PUBLIC BUILDINGS.

- .1 Administrative. Governmental.
- .11 Capitols. Houses of Parliament.
- .12 Ministries of War, State, etc.
- .13 City and Town Halls. Bureaus.
- .14 Public Offices. City Plans.
- .15 Custom Houses. Bonded Warehouses. Excise Offices.
- 725
- .15 Court Houses. Record Offices.
- .16 Post Offices. General and Special.
- .17 Official Residences. Palaces of Rulers.
- .18 Barracks. Armories. Police Stations.
- .19 Engine Houses. Fire Alarm Stations.

725.2

Business and Commercial.

- .21 Stores. Wholesale and Retail.
- .22 Mixed Store, Office, and Apartment Buildings.
- .23 Office Buildings. Telegraph. Insurance. Loft.
- .24 Banks. Safe Deposit. Savings.
- .25 Exchanges. Boards of Trade.
- .26 Markets.
- .27 Cattle Markets. Stock Yards.
- .28 Abattoirs, Meat Packing Plants, etc.
- .29 Other Business Buildings.

725.3

Transportation and Storage.

- .31 Railway Passenger Stations.
- .32 Railway Freight Houses.
- .33 Railway Shops, Round Houses, Car Houses, Tanks, Stores.
- .34 Dock Buildings. Wharf Boats and Houses.
- .35 1. Warehouses; 2. Cold Storage; 3. Safe Deposit Storage.
- .36 Elevators, Grain.
- .37
- .38
- .39 Other.

- 725.4 Manufactories.**
- .41 Textile Factories or Mills. Wool, Cotton, Silk.
 - .42 Breweries, Malteries. Distilleries.
 - .43 Foundries. Machine Shops. Iron and Steel Works.
 - .44 Wood-working Mills, Furniture, Piano and Organ Factories.
 - .45 Carriage and Car Factories.
 - .46 Paper Mills.
 - .47 Mills for Flour, Meal, Feed, etc.
 - .48 Pottery, Glass, Terra Cotta, Brick Works.
 - .49 Other Manufactories.
- 725.5 Hospitals and Asylums.** See also 725.6. Reformatories.
- .51 Sick and Wounded. Eye and Ear. Incurables. Lying-in.
 - .52 Insane.
 - .53 Idiotic. Feeble-minded.
 - .54 Blind. Deaf and Dumb.
 - .55 Paupers. Almshouses.
 - .56 Aged.
 - .57 Children. Orphans.
 - .58 Foundling.
 - .59 Soldiers' Homes.
- 725.6 Prisons and Reformatories.**
- .61 State Prisons. Penitentiaries.
 - .62 Jails. Cell Houses.
 - .63 Reformatories for Adults. Houses of Correction.
 - .64 Reform Schools.
 - .65 Inebriate Asylums.
- 725.7 Refreshment. Baths. Parks.**
- .71 Cafés. Restaurants.
 - .72 Saloons.
 - .73 Baths: Warm, Medicated, Turkish, Russian.
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ELEVATORS—PASSENGER AND FREIGHT

Otis Elevator Co., 600 W. Jackson Blvd.	82
Westinghouse Elevator Co., 1500 N. Branch	84

ENAMELS.

Pratt & Lambert, Inc., 320 W. 26th St.	572
U. S. Gutta Percha Paint Co., 659 W. Washington Blvd.	580

ENGINEERS—CONSULTING.

Hunt, Robt. W., Co., 175 W. Jackson Blvd.	24
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ESCALATORS.

Otis Elevator Co., 600 W. Jackson Blvd.	82
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EXCAVATING.

Herlihy Mid-Continent Co., 228 N. La Salle St.	1
Newman, W. J., Co., 21 N. Curtis St.	316

EXHAUST FANS.

Westinghouse Electric & Mfg. Co., 20 N. Wacker Dr.	320
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EXITS.

(See Fire Escapes.)

EXIT SIGNS—ELECTRIC.

Robinson, T. L., & Co., 1458 W. Kinzie St.	594
Tablet & Ticket Co., 1021 W. Adams St.	22

FAUCETS.

Chicago Faucet Co., 2712 N. Crawford	552
Crane Co., 836 S. Michigan Ave.	482-544
Ryan, J. J., & Co., 4301 W. Kinzie St.	562

FENCE—FACTORY.

Cyclone Fence Co., Waukegan, Ill.	46
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FENCE POSTS—CAST IRON.

Cyclone Fence Co., Waukegan, Ill.	46
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FIRE DOORS.

Variety Fire Door Co., 2958 Carroll Ave.	612
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FIRE ESCAPES.

Johnson, Chas., & Son, Fire Escape Co., 859 N. Spaulding Ave.	398
Union Fdry. Works, 38 S. Dearborn St.	612

FIRE EXTINGUISHERS.

(See Sprinkler Systems)

FIRE WINDOWS.

Detroit Steel Prod. Co., 111 W. Wash.	18
Federal Steel Sash Co., 228 N. La Salle	394
Lupton, David, Sons Co., 333 N. Michigan	20

FIREPLACES.

Colonial Fireplace Co., 4626 W. Roosevelt	80
Interior Tiling Co., 21 E. Van Buren St.	428

FIREPROOF PARTITIONS.

Ill. Fire Proof Constr. Co., 228 N. La Salle	426
Nat. Fire Proofing Co., 228 N. La Salle St.	424
Simplex Steel Prod. Co., 1146 Roscoe St.	600
U. S. Gypsum Co., 300 W. Adams St.	38

FIREPROOF SHUTTERS AND DOORS.

(See Iron Doors and Shutters)

FIREPROOFING.

Ill. Fire Proof Constr. Co., 228 N. La Salle	426
Nat. Fire Proofing Co., 228 N. La Salle St.	424
U. S. Gypsum Co., 300 W. Adams St.	38

FLOOR DRAINS.

Wade Iron Sanitary Mfg. Co., 1717 S. Canal St. 554

FLOOR FILL

Aerocrete Western Corp., 612 N. Michigan 78

FLOOR PLATES—WROUGHT IRON.

Union Fdry. Works, 38 S. Dearborn St. 612

FLOORING—HARDWOOD.

Bishop Lumber Co., 2315 Elston Ave. 442
Cunningham, C. B., 612 N. Michigan Ave. Inside Front Cover
Hines, Ed., Lumber Co., 2431 S. Lincoln 444
Rittenhouse & Embree Co., 3500 S. Racine 446
Robbins Flooring Co., Rhinelander, Wis. 472
Wisconsin Land & Lumber Co., Hermansville, Mich. Inside Front Cover

FLOORS—ACID PROOF.

Fulton Asphalt Co., 228 N. La Salle St. 56
Moore, Edw., Roofing Co., 2729 W. Madison St. 44

FLOORS—ART MARBLE.

Chicago Art Marble Co., 2883 Hillock 32
O'Neill, W. J., Floors, Inc., 166 W. Jackson 76

FLOORS—ASPHALT.

Fulton Asphalt Co., 228 N. La Salle St. 56
Moore, Edw., Roof'g Co., 2729 W. Madison 44
O'Neill, W. J., Floors, Inc., 166 W. Jackson 76

FLOORS—COMPOSITION.

Chicago Art Marble Co., 2883 Hillock Ave. 32
Kalman Floor Co., 400 N. Michigan Ave. 72
Moulding-Brownell Corp., 165 W. Wacker 66
O'Neill, W. J., Floors, Inc., 166 W. Jackson 76

FLOORS—MOSAIC.

Interior Tiling Co., 21 E. Van Buren St. 428
Western Mosaic & Terazzo Co., 4214 Ogden Ave. 26

FLOORS—RUBBER TILE.

O'Neill, W. J., Floors, Inc., 166 W. Jackson 76
Wright Rubber Products Co., Racine, Wis. 4

FLUE LININGS.

Am. Terra Cotta & Ceramic Co., 228 N. La Salle St. 34
Ill. Fire Proof Constr. Co., 228 N. La Salle 426
Midland Terra Cotta Co., 105 W. Monroe 28
Nat. Fire Proofing Co., 228 N. La Salle 424
Northwestern Terra Cotta Co., 2525 Clybourn Ave. 10

FORGINGS.

American Bridge Co., 208 S. La Salle St. 390
Inland Steel Co., 38 S. Dearborn St. 396

FORMS—CONCRETE

Concrete Eng. Co., 201 N. Wells St. 400

FOUNDATIONS.

Herlihy Mid-Continent Co., 228 N. La Salle St. 1

FOUNDRIES.

Union Foundry Works, 38 S. Dearborn 612

FURNITURE, SPECIAL DESIGN.

Nelson, W. P., Co., 153 W. Ohio St. 582

FUSE RENEWABLE.

Economy Fuse & Mfg. Co., 2711 Greenview Ave. 352-353

Trumbull Electric Mfg. Co., 2001 W. Pershing Road 324
Westinghouse Electric & Mfg. Co., 20 N. Wacker Drive 320

GARAGE DOOR STOPS.

Grand Specialties Co., 3101 W. Grand 90

GARAGE DRAINS.

Wade Iron Sanitary Mfg. Co., 1717 S. Canal St. 554

GARBAGE CREMATORIES.

Kerner Incinerator Co., 43 E. Ohio St. 478
Kewanee Boiler Co., 1858 S. Western Ave. 476
May-Connole, 188 W. Randolph St. 508
Stearns Incinerator Co., 188 W. Randolph St., and Syracuse, N. Y. 508
Weil-McLain Co., 641 W. Lake St. 480

GAS BOILERS.

Bryant Heater & Mfg. Co., 122 S. Mich. 502
Peoples Gas, Light & Coke Co., 122 S. Michigan Ave. 380-500

GAS FITTING.

(See Plumbing, Gas Fitting, and Sewerage)

GAS FIXTURES.

Peoples Gas, Light & Coke Co., 122 S. Michigan Ave. 380-500

GAS LOGS AND GAS GRATES.

Colonial Fireplace Co., 4626 W. Roosevelt 80
Peoples Gas, Light & Coke Co., 122 S. Michigan Ave. 380-500

GAS RADIATORS.

(See Radiators—Gas)

GAS RANGES AND STOVES.

Cribben & Sexton Co., 700 N. Sacramento 382
Crown Stove Wks., 4631 W. 12th Place 384
Peoples Gas, Light & Coke Co., 122 S. Michigan Ave. 380-500
Pick-Barth, Albert, Cos., 1200 W. 35th St. 6
Van Range, John, Co., 1200 W. 35th St. 6

GENERAL CONTRACTORS.

Anderson & Co., 37 W. Van Buren St. 156
Anderson, A. & E. Co., 221 N. La Salle St. 152
Anderson, Edward A., Co., 566 Center St., Winnetka, Ill. 140
Ardmore Constr. Co., 105 W. Monroe St. 142
Barnard, H. B., 140 N. Dearborn St. 102
Black, Robert, Co., 122 S. Michigan Ave. 130
Brundage, Avery, Co., 110 S. Dearborn 114
Bulley & Andrews, 2040 W. Harrison St. 134
Dahl-Stedman Co., 11 S. La Salle St. 108
Duffy-Noonan Constr. Co., 168 W. Adams 132
Ericsson, Henry, Co., 228 N. La Salle St. 104
Ericsson, John E., Co., 123 W. Madison St. 138
French, J. B., Co., 30 N. Michigan Ave. 136
Friestedt, A. F., Co., 431 N. Michigan Ave. 146
Gage, Thos. G., Co., 64 W. Randolph St. 144
Great Lakes Constr. Co., 28 E. Jackson 148
Griffiths, John, & Son Co., 228 N. La Salle 94
Hanson Brothers Co., 127 N. Dearborn St. 312
Herlihy Mid-Continent Co., 228 N. La Salle St. 1
Jacobson Bros., 53 W. Jackson Blvd. 154
Krahl Constr. Co., 350 N. Clark St. 122
Lanquist Constr. Co., 1100 N. Clark St. 100
Larson, Algot B., Co., 3833 W. Lake St. 116
Lynch, W. J., Co., 844 Rush St. 150
McKeown Bros. Co., 112 W. Adams St. 118
Moses, C. A., Constr. Co., 168 W. Adams 106
Nielsen, S. N., Co., 3059 Augusta St. 120
Ryan, Henry B., Co., 500 N. Dearborn St. 314

Simmons, J. L., Co., 4010 W. Madison St.	126
Snyder, J. W., Co., 307 N. Michigan Ave.	96
Sollitt, Ralph, & Sons Constr. Co., 228 N. LaSalle St.	124
Strandberg, E. P., Co., 232 E. Erie St.	112
Thompson-Starrett Co., 104 S. Michigan	98
Thomson, Geo. & Son Co., 30 N. La Salle	110
Turner Constr. Co., 228 N. La Salle St.	128
Wilson, R. E. & Co., 1851 Elston Ave.	92

GLASS—PRISMATIC.

Am. 3-Way Luxfer Prism Co., 1313 S. 55th St., Cicero, Ill.	598-599
Richards and Kelly Mfg. Co., 311 W. 23rd	592

GLASS—PLATE—SETTING.

Zouri Co., Chicago Heights, Ill.	590
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GLASS—ORNAMENTAL.

Robinson, T. L., & Co., 1458 W. Kinzie St.	594
Western Sandblast Mfg. Co., 1458 W. Kinzie St.	594

GLASS—STRUCTURAL.

Sanitary Constr. Co., 1476 W. Austin Ave.	558
Vitrolite Co., 120 S. La Salle St.	553

GLASSWARE—ILLUMINATING.

Inland Glass Wks., Inc., 20 N. Wacker Dr.	334
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GRAIN ELEVATOR MACHINERY.

Olson, Samuel, & Co., 1238 N. Kostner	14
Webster & Weller Mfg. Companies, 1826 N. Kostner Ave.	88

GRANITE.

Cold Springs Granite Co., 228 N. La Salle	438
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GRATES AND FIREPLACES.

Colonial Fireplace Co., 4626 W. Roosevelt	80
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GREASE TRAPS.

Wade Iron Sanitary Mfg. Co., 1717 S. Canal St.	554
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GREENHOUSES

Foley Greenhouse Mfg. Co., Forest Pk., Ill.	42
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GRILLE WORK—METAL.

(See Iron Work—Ornamental)

GYPSUM PRODUCTS.

U. S. Gypsum Co., 300 W. Adams St.	38
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HARDWOOD FLOORING.

(See Flooring—Hardwood)

HEADSTONES.

Blake, Chas. G., Co., 1000 E. 67th St.	158
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HEAT REGULATION.

Davis Regulator Co., 2541 S. Washtenaw	539
Johnson Service Co., 1355 Washington	537
Marsh, Jas. P., & Co., 2037 Southport Ave.	494
Milwaukee Valve Co., Milwaukee, Wis.	492
Powers Regulator Co., 2796 Greenview	556

HEATERS—OIL.

Lammert & Mann Co., 221 N. Wood St.	506
Ray Burner Corp., 2306 Wabansia Ave.	504

HEATING APPARATUS.

Am. Radiator Co., 816 S. Michigan	488-564
Bryant Heater & Mfg. Co., 122 S. Mich.	502
Clow, Jas. B., & Sons, 201 N. Talman Ave.	540
Dunham, C. A., Co., 450 E. Ohio St.	486 and Inside Back Cover
Gillespie-Dwyer Co., 2237 W. Lake St.	520
Ill. Eng. Co., W. 21st & S. Racine	496
Kellogg-Mackay Co., 1351 W. 37th St.	474
Kewanee Boiler Co., 1858 S. Western Ave.	476
Lammert & Mann Co., 221 N. Wood St.	506
Marsh, Jas. P., & Co., 2037 Southport Ave.	494
Orr & Sembover, Inc., 208 N. Clinton St.	490
Ray Burner Corp., 2306 Wabansia Ave.	504
Trane Co., 919 N. Michigan Ave.	498
Weil-McLain Co., 641 W. Lake St.	480

HEATING CONTRACTORS—HOT WATER—STEAM—VACUUM—VAPOUR.

Evans, Chas. E., & Co., 7 S. May St.	516
Glennon-Bielke Co., 3045 Irving Pk Blvd.	535
Gordon, Robert, Inc., 22 W. Austin Ave.	512
Ill. Engr. Co., W. 21st and S. Racine	496
Kaiser, E. B., 625 Webster Ave.	568
Kilander, A., & Co., 126 S. Clinton St.	534
Mehring & Hanson Co., 162 N. Clinton	536
Nilson Bros., 3222 N. Halsted St.	536
Phillips-Getschow Co., 421 N. State St.	535
Pope, William A., 26 N. Jefferson St.	534
Reger, H. P., & Co., 1501 E. 72nd Place	514
Watson, W. W., 708 Carpenter St.	537

HEATING—INDUSTRIAL.

Dunham, C. A., Co., 450 E. Ohio St.	486 and Inside Back Cover
Marsh, Jas. P., & Co., 2037 Southport Ave.	494
Westinghouse Electric & Mfg. Co., 20 N. Wacker Drive	320

HECTOGRAPH PRINTS.

Crofoot, Nielsen & Co., 14 N. Franklin	596
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HOISTING MACHINERY.

Sasgen Derrick Co., 3103 W. Grand Ave.	90
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HOLLOW TILE.

Ill. Fire Proof Constr. Co., 228 N. La Salle	426
Nat. Fire Proofing Co., 228 N. La Salle St.	424

HOT BLAST HEATING.

B & F Heating & Ventilating Co., 228 N. La Salle St.	510
Gillespie-Dwyer Co., 2237 W. Lake St.	520
Haines Co., 1929 W. Lake St.	518
Monarch Vent. Co., 1523 Kingsbury St.	538
Western Ventilating & Engineering Co., 24 S. Clinton St.	538

HOT WATER HEATERS.

Bryant Heater & Mfg. Co., 122 S. Mich.	502
Crane Co., 836 S. Michigan Ave.	482-544
Kewanee Boiler Co., 1858 S. Western Ave.	476

HOTEL SUPPLIES.

Pick-Barth, Albert, Cos., 1200 W. 35th St.	6
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HOUSE MOVERS AND RAISERS.

Friestedt, L. P., Co., 7 S. Dearborn St.	318
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HYDRANTS.

Chicago Faucet Co., 2712 N. Crawford	552
Crane Co., 836 S. Michigan Ave.	482-544
Ryan, J. J., & Co., 4301 W. Kinzie St.	562

HYDRAULIC ELEVATORS.

(See Elevators, Passenger and Freight)

ICE CONVEYING MACHINERY.

Olson, Samuel, & Co., 1238 N. Kostner 14
 Webster & Weller Mfg. Companies, 1826
 N. Kostner Ave. 88

ICE MACHINERY

Carbondale Machine Co., 325 W. Huron 366
 Midwest Engineering & Equipment, 617
 Fulton St. 364

INCINERATORS—GARBAGE.

Kerner Incinerator Co., 43 E. Ohio St. 478
 Kewanee Boiler Co., 1858 S. Western Ave. 476
 Stearns Incinerator Co., 188 W. Randolph
 St., and Syracuse, N. Y. 508
 Weil-McLain Co., 641 W. Lake St. 480

INDIANA LIMESTONE.

Heltonville Limestone Co., 20 N. Wacker 434
 Indiana Limestone Corp., 435 N. Michigan 432

INDUSTRIAL HEATING.

Marsh, Jas. P., & Co., 2037 Southport Ave. 494
 Westinghouse Electric & Mfg. Co., 20 N.
 Wacker Drive 320

INDUSTRIAL LIGHTING.

Beardslee Chandelier Mfg. Co., 216 S.
 Jefferson St. 332
 Commonwealth Edison Co., 72 W. Adams
 St. 354-374
 Inland Glass Wks., Inc., 20 N. Wacker Dr. 334
 Robinson, T. L., & Co., 1458 W. Kinzie St. 594

INSPECTORS.

Hunt, Robert, W., Co., 175 W. Jackson 24

INSULATION.

Cent. Asbestos & Mag. Co., 214 W. Grand 524
 Johns-Manville Sales Corp., 230 N. Mich-
 igan Ave. 8
 Krez, Paul J., Co., 444 N. La Salle St. 522
 Masonite Corp., 111 W. Washington St. 74
 Matot, D. A., 1538 Montana St. 54
 Standard Asbestos Mfg. Co., 820 W. Lake 526

INSULATING MATERIALS.

Johns-Manville Sales Corp., 230 N. Mich-
 igan Ave. 8
 Masonite Corp., 111 W. Washington St. 74
 Westinghouse Electric & Mfg. Co., 20 N.
 Wacker Drive 320

INTERIOR FINISH.

Baumann Mfg. Co., 1501 Smith Ave. 460
 Carlson, Aaron, Inc., 1505 Central Ave. N.
 E., Minneapolis, Minn. 458
 Carlson, Holmes & Bromstad, Inc., 3231
 W. 30th St. 462
 Edmunds Mfg. Co., 2016 Washburne Ave. 448
 Kaszab, Joseph, 1436 W. 21st St. 454
 Matthews Bros. Mfg. Co., 333 N. Mich-
 igan Ave. 450
 Ringwald, B. R., & Sons Co., 8082 So. Chi-
 cago Ave. 456
 West Woodworking Co., 300 N. Ada St. 452

IRON DOORS AND SHUTTERS.

Architectural Bronze & Aluminum Co.,
 5315 Ravenswood Ave. 420
 Atlas Iron Wks., Inc., 351 W. 59th St. 404
 General Bronze Corp., 228 N. La Salle St. 416
 Heath, J. S., Co., Waukegan, Ill. 410
 Ingeman, L. S., Ornamental Iron Co., 157
 Wendell St. 412
 Seymour Arch'l. Iron Co., 1635 Fulton St. 422
 Variety Fire Door Co., 2958 Carroll Ave. 612
 Western Archl. Iron Co., 3455 Elston Ave. 408
 Woodbridge Ornamental Iron Co., 1519
 Altgeld St. 406

IRON STAIRS—RAILINGS AND FENCES.

(See Architectural Iron and Bronze)

IRON STORE FRONTS.

(See Architectural Iron Work)

IRON WORK—ORNAMENTAL.

Architectural Bronze & Aluminum Co.,
 5315 Ravenswood Ave. 420
 Atlas Iron Wks., Inc., 351 W. 59th St. 404
 General Bronze Corp., 228 N. La Salle St. 416
 Heath, J. S., Co., Waukegan, Ill. 410
 Ingeman, L. S., Ornamental Iron Co., 157
 Wendell St. 412
 Seymour Arch'l. Iron Co., 1635 Fulton St. 422
 Union Foundry Wks., 38 S. Dearborn St. 612
 Western Archl. Iron Co., 3455 Elston Ave. 408
 Woodbridge Ornamental Iron Co., 1519
 Altgeld St. 406

IRON WORK—STRUCTURAL.

(See Structural Iron and Steel)

IRONING MACHINES (ELECTRIC)

Commonwealth Edison Co., 72 W. Adams
 St. 354-374

KALSOMINE.

Moore, Benj., & Co., 415 N. Green St. 578

KITCHENS—STEEL.

Pick-Barth, Albert, Cos., 1200 W. 35th St. 6

LABORATORY—TESTING.

Hunt, Robert W., Co., 175 W. Jackson 24

LAMPS.

Beardslie Chandelier Mfg. Co., 216 S. Jef-
 ferson St. 332
 Inland Glass Wks., Inc., 20 N. Wacker Dr. 334
 Westinghouse Electric & Mfg. Co., 20 N.
 Wacker Drive 320

LAMPS, EXTERIOR—IRON AND BRONZE.

Architectural Bronze & Aluminum Co.,
 5315 Ravenswood Ave. 420
 Atlas Iron Wks., Inc., 351 W. 59th St. 404
 General Bronze Corp., 228 N. La Salle St. 416
 Heath, J. S., Co., Waukegan, Ill. 410
 Ingeman, L. S., Ornamental Iron Co., 157
 Wendell St. 412
 Seymour Arch'l. Iron Co., 1635 Fulton St. 422
 Western Archl. Iron Co., 3455 Elston Ave. 408
 Woodbridge Ornamental Iron Co., 1519
 Altgeld St. 406

LATH.

Bishop Lumber Co., 2315 Lincoln Ave. 442
 Hines, Ed., Lumber Co., 2431 S. Lincoln 444
 Rittenhouse & Embree Co., 3500 S. Racine 446

LATH—METAL AND WIRE.

Concrete Engineering Co., 201 N. Wells 400
 Voss, Frederick, 522 W. Monroe St. 613

LAUNDRY TRAYS AND KITCHEN SINKS.

Clow, Jas. B., & Sons, 201 N. Talman Ave. 540
 Crane Co., 836 S. Michigan Ave. 482-544
 Kellogg-Mackay Co., 1351 W. 37th St. 474
 Standard Sanitary Mfg. Co., 900 S. Mich-
 igan Ave. 542
 Weil-McLain Co., 641 W. Lake St. 480

LIABILITY INSURANCE.

Builders & Mfrs. Mutual Casualty Co.,
 120 S. La Salle St. 2

LIGHTING FIXTURES.

(See Electric Fixtures)

LIME.

Marblehead Lime Co., 160 N. La Salle St.	70
Wisconsin Lime & Cement Co., 111 W. Washington St.	68

LIME PRODUCTS.

Marblehead Lime Co., 160 N. La Salle St.	70
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LIMESTONE

(See Indiana Limestone)

LINOLEUM

Pick-Barth, Albert, Cos., 1200 W. 35th St.	6
O'Neill, W. J., Floors, Inc., 166 W. Jackson	76

LIQUID SOAP FIXTURE

Imperial Brass Mfg. Co., 1232 W. Harrison St.	546
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LUMBER.

Bishop Lumber Co., 2315 Lincoln Ave.	442
Hines, Ed., Lumber Co., 2431 S. Lincoln	444
Rittenhouse & Embree Co., 3500 S. Racine	446

MACHINISTS.

Gordon, Robert, Inc., 22 W. Austin Ave.	512
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MAGNESIA PRODUCTS.

Cent. Asbestos & Mag. Co., 214 W. Grand	524
Johns-Manville Sales Corp., 230 N. Michigan Ave.	8
Krez, Paul J., Co., 444 N. La Salle St.	522
Standard Asbestos Mfg. Co., 820 W. Lake	526

MAIL CHUTES.

Cutler Mail Chute Co., Rochester, N. Y.	414
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MANHOLE COVERS.

Wade Iron Sanitary Mfg. Co., 1717 S. Canal St.	554
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MANTELS.

Colonial Fireplace Co., 4626 W. Roosevelt	80
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MAPLE FLOORING.

Cunningham, C. E., 612 N. Michigan Ave.	
Inside Front Cover	
Robbins Flooring Co., Rhinelander, Wis.	472
Wisconsin Land & Lumber Co., Hermansville, Mich.	
Inside Front Cover	

MARBLE—ART

Chicago Art Marble Co., 2883 Hillock Ave.	32
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MASON CONTRACTORS.

Anderson & Co., 37 W. Van Buren St.	156
Anderson, A. & E. Co., 221 N. La Salle St.	152
Anderson, Edward A., Co., 566 Center St., Winnetka	140
Ardmore Constr. Co., 105 W. Monroe St.	142
Barnard, H. E., Co., 140 S. Dearborn St.	102
Black, Robert, Co., 122 S. Michigan Ave.	130
Brundage, Avery, Co., 110 S. Dearborn	114
Bulley & Andrews, 2040 W. Harrison St.	134
Dahl-Stedman Co., 11 S. La Salle St.	108
Duffy-Noonan Constr. Co., 168 W. Adams	132
Ericsson, Henry, Co., 228 N. La Salle St.	104
Ericsson, John E., Co., 123 W. Madison St.	138
French, J. B., Co., 30 N. Michigan Ave.	136
Friedstedt, H. F., Co., 431 N. Michigan	146
Gage, Thos. G., Co., 64 W. Randolph St.	144
Great Lakes Constr. Co., 333 N. Michigan	148
Griffiths, John, & Son, 228 N. La Salle St.	94
Hanson Bros. Co., 127 N. Dearborn St.	312
Jacobson Bros., 53 W. Jackson Blvd.	154

Krahl Constr. Co., 350 N. Clark St.	122
Lanquist Constr. Co., 1100 N. Clark St.	100
Larson, Algot B., Co., 3833 W. Lake St.	116
Lynch, W. J., Co., 844 Rush St.	150
Moses, C. A., Constr. Co., 168 W. Adams	106
Nielsen, S. N., Co., 3059 Augusta St.	120
Ryan, Henry B., Co., 500 N. Dearborn St.	314
Simmons, J. L., Co., 4010 W. Madison St.	126
Sollitt, Ralph, & Sons Constr. Co., 228 N. La Salle St.	124
Snyder, J. W., Co., 307 N. Michigan Ave.	96
Strandberg, E. P., Co., 232 E. Erie St.	112
Thompson-Starrett Co., 104 S. Michigan	98
Thomson, Geo., & Son Co., 30 N. La Salle	110
Turner Constr. Co., 228 N. La Salle St.	128
Wilson, R. F., & Co., 1851 Elston Ave.	92

MATERIAL HOISTS.

Sasgen Derrick Co., 3103 W. Grand Ave.	90
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MAUSOLEUMS

Blake, Charles G., Co., 1000 E. 67th St.	158
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METAL CEILINGS & WALLS.

Friedley-Voshardt Co., 763 Mather St.	418
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METAL LATH.

Concrete Eng. Co., 201 N. Wells St.	400
Voss, Frederick, 522 W. Monroe St.	613

METAL, SASH & FRAMES.

Biegler, Louis, Co., 165 N. Curtis St.	539
Detroit Steel Prod. Co., 111 W. Wash'tn	18
Federal Steel Sash Co., 228 N. La Salle St.	394
Lupton David, Sons Co., 333 N. Michigan	20

MILL WORK.

Baumann Mfg. Co., 1501 Smith Ave.	460
Carlson, Aaron, Inc., 1505 Central Ave. N. E., Minneapolis, Minn.	458
Carlson, Holmes & Bromstad, Inc., 3231 W. 30th St.	462
Curtis Door & Sash Co., 1414 S. Western	464
Edmunds Mfg. Co., 2016 Washburne Ave.	448
Matthews Bros. Mfg. Co., 333 N. Michigan	450
Ringwald, B. R. & Sons, Co., 8082 So. Chicago Ave.	454
West Woodworking Co., 300 N. Ada St.	452

MONUMENTS.

Blake, Charles G., Co., 1000 E. 67th St.	158
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MOSAICS.

Interior Tiling Co., 21 E. Van Buren St.	428
Western Mosaic & Terrazzo Co., 4214 Ogden Ave.	26

MURAL DECORATIONS.

Nelson, W. P., Co., 153 W. Ohio St.	582
Schilling & Co., 1333 Sedgwick St.	586

NEEDLE BATH WATER MIXERS.

Powers Regulator Co., 2796 Greenview	556
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NON-SLIP ART MARBLE FOR STEPS, TREADS, FLOORS & RAMPS.

Chicago Art Marble Co., 2883 Hillock Ave.	32
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OFFICE FIXTURES.

(See Interior Finish)

OIL BURNERS.

Lammert & Mann Co., 221 N. Wood St.	506
Ray Burner Corp., 2306 Wabasha Ave.	504
Orr & Sembower, Inc., 208 N. Clinton St.	490

OUTLET BOXES.

Appleton Electric Co., 1717 Wellington	322
Trumbull Electric Mfg. Co., 2001 W. Pershing Road	324

PACKAGE CONVEYORS

Olson, Samuel, & Co., 1238 N. Kostner 14
 Webster & Weller Mfg. Companies, 1826 88
 N. Kostner Ave.

PAINT—DAMP RESISTING.

Central Ironite Waterproofing Co., 111 W. 52
 Washington St.

PAINT—FIREPROOF.

Johns-Manville Sales Corp., 230 N. Mich- 8
 igan Ave. 578
 Moore, Benj., & Co., 415 N. Green St. 578
 U. S. Gutta Percha Paint Co., 659 W. 580
 Washington St.

PAINT—GRAPHITE.

Detroit Graphite Co., 20 N. Wacker Drive 576
 Moore, Benj., & Co., 415 N. Green St. 578
 U. S. Gutta Percha Paint Co., 659 W. 580
 Washington St.

PAINT—IRON.

Detroit Graphite Co., 20 N. Wacker Drive 576
 Moore, Benj., & Co., 415 N. Green St. 578
 U. S. Gutta Percha Paint Co., 659 W. 580
 Washington St.

PAINT—MIXED.

Detroit Graphite Co., 20 N. Wacker Drive 576
 Hockaday Co., 20 N. Wacker Drive 574
 Moore, Benj., & Co., 415 N. Green St. 578
 U. S. Gutta Percha Paint Co., 659 W. 580
 Washington St.

PAINTING CONTRACTORS.

Nelson, W. P., Co., 153 W. Ohio St. 582
 Noelle, J. B., Co., 868 N. Franklin St. 584
 Schilling & Co., 1333 Sedgwick St. 586

PANELBOARDS.

Berthold, Gus, Electric Co., 555 W. Mon- 328
 roe St. 324
 Trumbull Electric Mfg. Co., 2001 W. Per-
 shing Road 324
 Westinghouse Electric Mfg. Co., 20 W. 320
 Wacker Drive

PARTITION BLOCKS.

Aerocrete Western Corp., 612 N. Michigan 78

PARTITION & CEILING CONSTRUCTION.

Simplex Steel Prod. Co., 1146 Roscoe St. 600

PARTITION AND FLOOR DEADENING.

Simplex Steel Prod. Co., 1146 Roscoe St. 600

PARTITION—MOVABLE.

Dodge, H. B. & Co., 332 S. Michigan Ave. 48

PARTITION TILE.

(See Hollow Tile)

PARTITIONS—TOILET

Chicago Art Marble Co., 2883 Hillock Ave. 32
 Sanitary Constr. Co., 1476 W. Austin 558
 Vitrolite Co., 120 S. La Salle St. 588

PILING—WOOD.

Lake Superior Piling Co., 2464 S. Loomis 613

PIPE AND BOILER COVERING.

Cent. Asbestos & Mag. Co., 214 W. Grand 524
 Johns-Manville Sales Corp., 230 N. Mich- 8
 igan Ave. 522
 Krez, Paul J., Co., 444 N. La Salle St. 526
 Standard Asbestos Mfg. Co., 816 W. Lake

PLASTER.

U. S. Gypsum Co., 300 W. Adams St. 38

PLASTER BASE.

Simplex Steel Prod. Co., 1146 Roscoe St. 600

PLASTER BOARD.

U. S. Gypsum Co., 300 W. Adams St. 38

PLASTERING CONTRACTORS.

Brown, James J., Plastering Co., 176 W. 606
 Adams St. 608
 Burson Bros., 118 E. 30th St. 611
 Goss & Guise, 228 N. La Salle St. 610
 Kalteux & Brown Co., 123 W. Madison St. 604
 Lennox-Haldeman Co., 208 S. La Salle St. 610
 McNulty Bros. Co., 1028 W. Van Buren 610
 Parent, N. J., Co., 5 S. Wabash Ave. 602
 Zander-Reum Co., 7 S. Dearborn St.

PLATE GLASS SETTING

Zouri Co., Chicago Heights, Ill. 590

PLUMBING SUPPLIES.

Clow, James B., & Sons, 201 N. Talman 540
 Crane Co., 836 S. Michigan Ave. 482-544
 Imperial Brass Mfg. Co., 1232 W. Harrison 536
 Kellogg-Mackay Co., 1351 W. 37th St. 474
 Standard Sanitary Mfg. Co., 900 S. Mich. 542
 Weil-McLain Co., 641 W. Lake St. 480

**PLUMBING, GASFITTING AND SEWER-
AGE.**

Corboy, M. J., Co., 405 N. Desplaines St. 566
 Evans, Chas. E., & Co., 7 S. May St. 516
 Kaiser, E. B., 625 Webster 568
 Nilson Bros., 3222 N. Halsted St. 536
 Reger, H. P., & Co., 1501 E. 72nd Pl. 514
 Watson, W. W., 708 Carpenter St. 570
 Young, E. J., & Co., 416 W. Erie St.

PNEUMATIC TUBE SYSTEM.

Olson, Samuel, & Co., 1238 N. Kostner 14

POST CAPS.

Cyclone Fence Co., Waukegan, Ill. 46

POWER EQUIPMENT.

Stannard Power Equipment Co., 53 W. 484
 Jackson Blvd.

PUMPS—AUTOMATIC AND HYDRAULIC.

American Steam Pump Co., 53 W. Jackson 484
 Blvd. 498
 Trane Co., 919 N. Michigan Ave. 554
 Wade Iron Sanitary Mfg. Co., 1717 S.
 Canal St.

PUMPS—ELECTRIC.

Trane Co., 919 N. Michigan Ave. 498
 Wade Iron Sanitary Mfg. Co., 1717 S. 554
 Canal St. 320
 Westinghouse Electric & Mfg. Co., 20 N.
 Wacker Drive

PUMPS—STEAM.

American Steam Pump Co., 53 W. Jackson 484
 Blvd. 498
 Trane Co., 919 N. Michigan Ave.

RADIATORS.

Am. Radiator Co., 816 S. Michigan Ave. 488-564
 Kewanee Boiler Co., 1858 S. Western Ave. 476

RADIATORS—GAS.

Clow, James B., & Sons, 201 N. Talman 540
Peoples Gas Light & Coke Co., 122 S.
Michigan Ave. 380-500

RADIATOR VALVES—PACKLESS.

Am. Radiator Co., 816 S. Michigan Ave. 488-564
482-544
Crane Co., 836 S. Michigan Ave. 486 and Inside Back Cover
Dunham, C. A., Co., 450 E. Ohio St. 496
Ill. Eng. Co., W. 21st and S. Racine Ave. 492
Milwaukee Valve Co., Milwaukee, Wis. 498
Trane Co., 919 N. Michigan Ave. 498

RANGES—ELECTRIC.

Commonwealth Edison Co., 72 W. Adams St. 354-374
Westinghouse Electric & Mfg. Co., 20 N. Wacker Drive 320

RECREATION ROOM EQUIPMENT.

Brunswick-Balke-Collender Co., 623 S. Wabash Ave. 12-550

REFLECTORS—DIRECT & INDIRECT.

Beardslee Chandelier Mfg. Co., 216 S. Jefferson Ave. 332
Commonwealth Edison Co., 72 W. Adams St. 354-374
Inland Glass Wks., Inc., 20 W. Wacker 334
Robinson, T. L., & Co., 1458 W. Kinzie St. 594
Westinghouse Electric & Mfg. Co., 20 N. Wacker Drive 320

REFRIGERATION.

B. & F. Heating & Vent. Co., 228 N. La Salle St. 510
Kaiser, E. B., 625 Webster 568

REFRIGERATING MACHINERY.

Carbondale Machine Co., 325 W. Huron 366
Midwest Engineering & Equipment Co., 617 Fulton St. 364

REFRIGERATOR CABINETS.

Commonwealth Edison Co., 72 W. Adams St. 354-374
Matot, D. A., 158 Montana St. 54
Pick-Barth, Albert, Cos., 1200 W. 35th St. 6
Van Range, John, Co., 1200 W. 35th St. 6

REFRIGERATORS—ELECTRIC.

Carbondale Machine Co., 325 W. Huron 366
Commonwealth Edison Co., 72 W. Adams St. 354-374
Copeland Refrigeration Co., 160 E. Illinois St. 368
Cooper, R., Jr., Inc., 120 S. La Salle St. 372
Kelvinator, Chicago Co., 160 E. Illinois 378
Stover Co., 219 E. No. Water St. 376
Utility Appliance Corp., 180 N. Michigan 370

REFRIGERATORS—GAS.

Peoples Gas, Light & Coke Co., 122 S. Michigan Ave. 380-500

REGULATORS—DAMPER.

Davis Regulator Co., 2541 S. Washtenaw 539
Dunham, C. A., Co., 450 E. Ohio St. 486 and Inside Back Cover
Trane Co., 919 N. Michigan Ave. 498

REGULATORS—HEAT—STEAM—AIR—WATER.

Davis Regulator Co., 2541 S. Washtenaw 539
Dunham, C. A., Co., 450 E. Ohio St. 486 and Inside Back Cover
Johnson Service Co., 1355 Washington 537
Milwaukee Valve Co., Milwaukee, Wis. 492
Powers Regulator Co., 2796 Greenview 555
Trane Co., 919 N. Michigan Ave. 498

REINFORCEMENT BARS.

American Bridge Co., 208 S. La Salle St. 390
Calumet Steel Co., 33 N. La Salle St. 402
Concrete Engrng. Co., 201 N. Wells St. 400
Cyclone Fence Co., Waukegan, Ill. 46
Inland Steel Co., 38 S. Dearborn St. 396

RESTAURANT SUPPLIES.

Pick-Barth, Albert, Cos., 1200 W. 35th St. 6

ROOF DRAINS.

Wade Iron Sanitary Mfg. Co., 1717 S. Canal St. 554

ROOF INSULATION

Johns-Manville Sales Corp., 230 N. Michigan Ave. 8

ROOF SLABS.

Aerocrete Western Corp., 612 N. Michigan 78

ROOF TRUSSES.

American Roof Truss Co., 228 N. La Salle 470
McKeown Bros. Co., 112 W. Adams St. 118

ROOFING CONTRACTORS.

Moore, Edw., Rfg. Co., 2729 W. Madison 44

ROOFING—MATERIALS.

Johns-Manville Sales Corp., 230 N. Michigan Ave. 8
Moore, Edw., Rfg. Co., 2729 W. Madison 44

ROOFING TILE.

Federal American Cement Tile Co., 608 S. Dearborn St. 16
Ludowici-Celadon Co., 104 S. Michigan 40

RUBBER TILE.

O'Neill, W. J., Floors, Inc., 166 W. Jackson 76
Wright Rubber Products Co., Racine, Wis. 4

SAND AND GRAVEL.

Wisconsin Lime & Cement Co., 111 W. Washington St. 68

SASH, DOORS AND BLINDS.

(See Millwork)

SASH OPERATORS.

Detroit Steel Prod. Co., 111 W. Wash. 18
Federal Steel Sash Co., 228 N. La Salle St. 394
Lupton, David, Sons Co., 333 N. Michigan 20

SCREENS—WINDOW AND DOOR.

Chamberlin Metal Weather Strip Co., 704 S. Dearborn St. 50

SCUPPERS & FLOOR DRAINS.

Wade Iron Sanit. Mfg. Co., 1717 S. Canal 554

SEAT OPERATING CLOSETS.

Rundell-Spence Mfg. Co., Milwaukee, Wis. 543

SEATS—TOILET.

Brunswick-Balke-Collender Co., 623 S. Wabash Ave. 12-550
Rundell-Spence Mfg. Co., Milwaukee, Wis. 543

SEWER PIPE.

Am. Radiator Co., 816 S. Michigan 488-564

SEWAGE EJECTORS AND BILGE PUMPS.

Wade Iron Sanitary Mfg. Co., 1717 S. Canal 554

SHEATHING MATERIALS.

Johns-Manville, Inc., 230 N. Michigan

8

SHEET METAL CONTRACTORS.

B. & F. Heat. & Vent. Co., 228 N. La Salle 510
 Biegler, Louis, Co., 165 N. Curtis St. 539
 Gillespie-Dwyer Co., 2237 W. Lake St. 520
 Gordon, Robert, Inc., 22 W. Austin Ave. 512
 Haines Co., 1929 W. Lake St. 518
 Monarch Vent. Co., 1523 Kingsbury St. 538
 Western Ventilating & Engineering Co.,
 24 S. Clinton St. 538

SHEET METAL—ORNAMENTAL.

Friedley-Voshardt Co., 763 Mather St. 418

SHEET STEEL.

Inland Steel Co., 38 S. Dearborn St. 396

SHINGLES.

(See Lumber)

SHINGLES—FIREPROOF.

Cabot, Samuel, Inc., 5000 Bloomingdale 596
 Johns-Manville Sales Corp., 230 N. Mich-
 igan Ave. 8
 Moore, Edw., Rfg. Co., 2729 W. Madison 44

SHORING CONTRACTORS.

Friestedt, L. P. Co., 7 S. Dearborn St. 318

SHOWER MIXERS.

Powers Regulator Co., 2796 Greenview 556

SHOWER RECEPTORS.

Chicago Art Marble Co., 2883 Hillock St. 32

SHOWERS.

Powers Regulator Co., 2796 Greenview 556

SIDEWALK DOORS.

Am. 3-Way Luxfer Prism Co., 1313 S.
 55th Court, Cicero, Ill. 598-599
 Richards & Kelly Mfg. Co., 311 W. 23rd 592

SIDEWALK AND VAULT LIGHTS.

Am. 3-Way Luxfer Prism Co., 1313 S.
 55th Court, Cicero, Ill. 598-599
 Richards & Kelly Mfg. Co., 311 W. 23rd 592

SIGNS—CAST BRONZE.

Imperial Brass Mfg. Co., 1232 W. Harrison St. 546

SIGNS—CHANGEABLE.

Robinson, T. L., & Co., 1453 W. Kinzie St. 594
 Tablet & Ticket Co., 1021 W. Adams St. 22

SINKS—DISHWASHER.

Conover Co., 140 S. Dearborn St. 336

SKYLIGHTS.

Am. 3-Way Luxfer Prism Co., 1313 S.
 55th Court, Cicero, Ill. 598-599
 Biegler, Louis, Co., 165 N. Curtis St. 539
 Detroit Steel Products Co., 111 W. Wash. 18
 Federal American Cement Tile Co., 608 S.
 Dearborn St. 16
 Federal Steel Sash Co., 228 N. La Salle St. 394
 Lupton, David, Sons Co., 333 N. Michigan 20
 Richards & Kelly Mfg. Co., 311 W. 23rd 592

SLEEPER FILL.

Aerocrete Western Corp., 612 N. Michigan 78

SLUICE GATES.

Crane Co., 836 S. Michigan Ave. 482-544
 Imperial Brass Mfg. Co., 1232 W. Harrison 546
 Wade Iron Sanitary Mfg. Co., 1717 S.
 Canal St. 554

SMOKE STACK LININGS.

Cent. Asbestos & Mfg. Co., 214 W. Grand 524
 Johns-Manville Sales Corp., 230 N. Mich-
 igan Ave. 8
 Krez, Paul J., Co., 444 N. La Salle St. 522
 Standard Asbestos Mfg. Co., 816 W. Lake 526

SOIL PIPE.

Am. Radiator Co., 816 S. Michigan 488-564

SOLARIUMS.

Foley Greenhouse Mfg. Co., Forest Pk., Ill. 42

SOUND PROOFING.

Johns-Manville Sales Corp., 230 N. Mich-
 igan Ave. 8
 Masonite Corp., 111 W. Washington St. 74

SPIRAL CHUTES.

Olson, Samuel, & Co., 1238 N. Kostner 14
 Webster & Weller Mfg. Companies, 1826
 N. Kostner Ave. 88

STAINS.

Cabot, Samuel, Inc., 5000 Bloomingdale 596
 Detroit Graphite Co., 20 N. Wacker Drive 576
 Moore, Benj., & Co., 415 N. Green St. 578
 Pratt & Lambert, Inc., 320 W. 26th St. 572
 U. S. Gutta Percha Paint Co., 659 W.
 Washington St. 580

STAIRS AND RAILINGS—WOOD.

Baumann Mfg. Co., 1501 Smith Ave. 460
 Carlson, Aaron, Inc., 1505 Central Ave. N.
 E., Minneapolis, Minn. 458
 Carlson, Holmes & Bromstad, Inc., 3231
 W. 30th St. 462
 Edmunds Mfg. Co., 2016 Washburne Ave. 448
 Kaszab, Joseph, 1436 W. 21st St. 454
 Matthews Bros. Mfg. Co., 333 N. Michigan 450
 Ringwald, B. R., & Sons Co., 8082 S. Chi-
 cago Ave. 456
 West Woodworking Co., 300 N. Ada St. 452

STAIRS—IRON AND BRONZE.

(See Architectural Iron and Bronze)

STAIRS—STEEL.

Woodbridge Ornamental Iron Co., 1519 Altgeld St. 406

STEAM HEATING.

(See Heating—Hot Water and Steam)

STEAM GENERATORS.

Am. Radiator Co., 816 S. Michigan 488-564
 Johnson Service Co., 1355 Washtn. Blvd. 537
 Kewanee Boiler Co., 1858 S. Western Ave. 476

STEEL BARS FOR REINFORCING CONCRETE.

(See Reinforcing Bars)

STEEL PLATES.

Inland Steel Co., 38 S. Dearborn St. 396

STEEL SHUTTERS.

Dodge, H. B., & Co., 332 S. Michigan 48

STEEL WINDOWS.

Biegler, Louis, Co., 165 N. Curtis St. 539
 Detroit Steel Prod. Co., 111 W. Wash. 18
 Federal Steel Sash Co., 228 N. La Salle St. 394
 Lupton, David, Sons Co., 333 N. Michigan 20
 Metal Door & Trim, 228 N. La Salle St. 86

STOKERS.

Westinghouse Electric & Mfg. Co., 20 N. Wacker Drive 320

STONE—BUILDING.

Cold Spring Granite Co., 228 N. La Salle 438
 Heltonville Limestone Co., 20 N. Wacker Drive 434
 Indiana Limestone Corp., 435 N. Michigan Ave. 432

STONE—CAST.

Benedict Stone Inc., 1615 W. 74th Pl. 30

STONE—CRUSHED.

Wisconsin Lime & Cement Co., 111 W. Washington St. 68

STONE—SETTING

Archer Stone Setting Co., 228 N. La Salle 436

STORE FRONTS—METAL CONSTRUCTION.Federal Steel Sash Co., 228 N. La Salle St. 394
Zouri Co., Chicago Heights, Ill. 590**STORE AND OFFICE FIXTURES.**

Baumann Mfg. Co., 1501 Smith Ave. 460
 Carlson, Aaron, Inc., 1505 Central Ave. N. E., Minneapolis, Minn. 458
 Carlson, Holmes & Bromstad, Inc., 3231 W. 30th St. 462
 Edmunds Mfg. Co., 2016 Washburne Ave. 448
 Kaszab, Joseph, 1436 W. 21st St. 454
 Matthews Bros. Mfg. Co., 333 N. Michigan 450
 Pick-Barth, Albert, Cos., 1200 W. 35th St. 6
 Ringwald, B. R. & Sons Co., 8082 S. Chicago Ave. 456
 West Woodworking Co., 300 N. Ada St. 452

STOVES—GAS.

Cribben & Sexton Co., 700 N. Sacramento 382
 Crown Stove Works, 4631 W. 12th Place 384
 Peoples Gas, Light & Coke Co., 122 S. Michigan Ave. 380-500
 Pick-Barth, Albert, Cos., 1200 W. 35th St. 6
 Van Range, John Co., 1200 W. 35th St. 6

STRAINERS—SUCTION.

Dunham, C. A., 450 E. Ohio St. 486 and Inside Back Cover

STRUCTURAL IRON AND STEEL.

American Bridge Co., 208 S. La Salle St. 390
 Duffin Iron Co., 4837 S. Kedzie Ave. 392
 Inland Steel Co., 38 S. Dearborn St. 396
 Union Foundry Works, 38 S. Dearborn St. 612

STUCCO.

Marblehead Lime Co., 160 N. La Salle St. 70
 U. S. Gypsum Co., 300 W. Adams St. 38

SURETY BONDS.

Builders & Mfrs. Mutual Casualty Co., 120 S. La Salle St. 2

SWIMMING POOL ENCLOSURES.

Foley Greenhouse Mfg. Co., Forest Pk., Ill. 42

SWITCHBOARDS.

Berthold, Gus, Electric Co., 555 W. Monroe St. 328
 Trumbull Electric Mfg. Co., 2001 W. Pershing Road 324
 Westinghouse Electric & Mfg. Co., 20 N. Wacker Drive 320

SWITCHES—ELECTRIC.

Appleton Electric Co., 1717 Wellington 322
 Trumbull Electric Mfg. Co., 2001 W. Pershing Road 324
 Westinghouse Electric & Mfg. Co., 20 N. Wacker Drive 320

TANKS—IRON AND STEEL.

Kewanee Boiler Co., 1858 S. Western Ave. 476

TEMPERATURE REGULATORS.

Dunham, C. A., Co., 450 E. Ohio St. 486 and Inside Back Cover
 Johnson Service Co., 1355 Washington 537
 Powers Regulator Co., 2796 Greenview 556

TERRA COTTA.

Am. Terra Cotta & Ceramic Co., 228 N. La Salle St. 34
 Midland Terra Cotta Co., 105 W. Monroe 28
 Northwestern Terra Cotta Co., 2525 Clybourn Ave. 10

TERRAZZO.

Western Mosaic & Terrazzo Co., 4214 Ogden Ave. 26

THERMOSTATS.

Dunham, C. A., Co., 450 E. Ohio St. 486 and Inside Back Cover
 Johnson Service Co., 1355 Washington 537
 Powers Regulator Co., The, 2796 Greenview Ave. 556
 Trane Co., 919 N. Michigan Ave. 498

TILE—ART MARBLE.

Chicago Art Marble Co., 2883 Hillock Ave. 32

TILE—CERAMIC, ETC.

Interior Tiling Co., 21 E. Van Buren St. 428
 Western Mosaic & Terrazzo Co., 4214 Ogden Ave. 26

TILE—CORK.

O'Neill, W. J., Floors, Inc., 166 W. Jackson 76

TILE—FLOORS.

Interior Tiling Co., 21 E. Van Buren St. 428
 Western Mosaic & Terrazzo Co., 4214 Ogden Ave. 26

TILE—GYPSUM.

U. S. Gypsum Co., 300 W. Adams St. 38

TILE—HOLLOW.

Ill. Fire Proof Constr. Co., 228 N. La Salle 426
 Natl. Fireproofing Co., 228 N. La Salle St. 424

TILE—ROOF.

Federal American Cement Tile Co., 608 S. Dearborn St. 16
 Ludowici-Celadon Co., 104 S. Michigan 40

TILE RUBBER.

Wright Rubber Products Co., Racine, Wis. 4

TILE WAINSCOTING.

Chicago Art Marble Co., 2883 Hillock Ave. 32
 Interior Tiling Co., 21 E. Van Buren St. 428
 Western Mosaic & Terrazzo Co., 4214
 Ogden Ave. 26

TOILET PAPER DISPENSERS

Northern Paper Mills Co., 400 N. Michigan Ave. 560

TOILET PARTITIONS.

Chicago Art Marble Co., 2883 Hillock Ave. 32
 Sanitary Constr. Co., 1476 W. Austin 558
 Vitrolite Co., 120 S. La Salle St. 588

TOWEL CABINETS

Northern Paper Mills, 400 N. Michigan 560

TRAPS—STEAM.

Davis Regulator Co., 2541 S. Washtenaw 539
 Dunham, C. A., Co., 450 E. Ohio St. 486 and Inside Back Cover
 Ill. Engr. Co., W. 21st and S. Racine Ave. 496
 Milwaukee Valve Co., Milwaukee, Wis. 492
 Trane Co., 919 N. Michigan Ave. 498

TREADS—SAFETY.

Chicago Art Marble Co., 2883 Hillock Ave. 32

TRUSSES—WOOD.

American Roof Truss Co., 228 N. La Salle 470
 McKeown Bros. Co., 112 W. Adams St. 118

TURN TABLES.

American Bridge Co., 208 S. La Salle St. 390

URINAL STALLS.

Clow, Jas. B., & Sons, 201 N. Talman Ave. 540
 Crane Co., 836 S. Michigan Ave. 482-544
 Standard Sanitary Mfg. Co., 900 S. Mich. 542
 Weil-McLain Co., 641 W. Lake St. 480

VALVES—BACK PRESSURE.

Am. Radiator Co., 816 S. Michigan 488-564
 Crane Co., 836 S. Michigan Ave. 482-544
 Davis Regulator Co., 2541 S. Washtenaw 539
 Dunham, C. A., Co., 450 E. Ohio St. 486 and Inside Back Cover
 Ill. Eng. Co., W. 21st and S. Racine Ave. 496
 Milwaukee Valve Co., Milwaukee, Wis. 492
 Trane Co., 919 N. Michigan Ave. 498
 Wade Iron Sanitary Co., 1717 S. Canal 554

VALVES—FLUSH.

Crane Co., 836 S. Michigan Ave. 482-544
 Imperial Brass Mfg. Co., 1232 W. Harrison St. 546

VALVES—PACKLESS.

Am. Radiator Co., 816 S. Michigan 488-564
 Crane Co., 836 S. Michigan Ave. 482-544
 Dunham, C. A., Co., 450 E. Ohio St. 486 and Inside Back Cover
 Ill. Eng. Co., W. 21st and S. Racine Ave. 496
 Milwaukee Valve Co., Milwaukee, Wis. 492
 Trane Co., 919 N. Michigan Ave. 498

VALVES—PRESSURE REDUCING.

Am. Radiator Co., 816 S. Michigan 488-564
 Crane Co., 836 S. Michigan Ave. 482-544
 Dunham, C. A., Co., 450 E. Ohio St. 486 and Inside Back Cover
 Ill. Eng. Co., W. 21st and S. Racine Ave. 496
 Imperial Brass Mfg. Co., 1232 W. Harrison 546

Milwaukee Valve Co., Milwaukee, Wis. 492
 Powers Regulator Co., 2796 Greenview 556
 Trane Co., 919 N. Michigan Ave. 498

VALVES—REGULATING.

Am. Radiator Co., 816 S. Michigan 482-564
 Crane Co., 836 S. Michigan Ave. 482-544
 Davis Regulator Co., 2541 S. Washtenaw 539
 Dunham, C. A., Co., 450 E. Ohio St. 486 and Inside Back Cover
 Ill. Eng. Co., W. 21st and S. Racine Ave. 496
 Imperial Brass Mfg. Co., 1232 W. Harrison 546
 Milwaukee Valve Co., Milwaukee, Wis. 492
 Trane Co., 919 N. Michigan Ave. 498

VALVES—SPRINKLER ALARM.

(See Sprinkler Systems)

VALVE—VENT—AIR.

Am. Radiator Co., 816 S. Michigan 488-564
 Dunham, C. A., Co., 450 E. Ohio St. 486 and Inside Back Cover
 Milwaukee Valve Co., Milwaukee, Wis. 492
 Trane Co., 919 N. Michigan Ave. 498

VALVES—WATER MIXERS.

Am. Radiator Co., 816 S. Michigan 488-564
 Powers Regulator Co., 2796 Greenview 556

VARNISH MANUFACTURERS.

Moore, Benj., & Co., 415 N. Green St. 578
 Pratt & Lambert, Inc., 320 W. 26th St. 572

VENETIAN BLINDS.

Dodge, H. B., & Co., 332 S. Michigan Ave. 48

VENTILATORS.

Gillespie-Dwyer Co., 2237 W. Lake St. 520
 Western Ventilating & Eng. Co., 9 S. Clinton St. 538

VENTILATING SYSTEMS.

B. & F. Heating & Vent. Co., 228 N. La Salle St. 510
 Evans, Chas. E., & Co., 7 S. May St. 516
 Gillespie-Dwyer Co., 2237 W. Lake St. 520
 Glennon-Bleke Co., 3045 Irving Pk. Blvd. 535
 Gordon, Robt., Inc., 22 W. Austin Ave. 512
 Haines Co., 1929 W. Lake St. 518
 Kaiser, E. B., 625 Webster 568
 Kilander, A., & Co., 126 S. Clinton St. 534
 Mehring & Hanson Co., 162 N. Clinton St. 536
 Monarch Vent. Co., 1523 Kingsbury St. 538
 Phillips, Getschow Co., 421 N. State St. 535
 Pope, Wm. A., 26 N. Jefferson St. 534
 Reger, H. P., & Co., 1501 E. 72nd Place 514
 Western Ventilating & Engineering Co., 24 S. Clinton St. 538

WAINSCOTING

Chicago Art Marble Co., 2883 Hillock Ave. 32
 Interior Tiling Co., 21 E. Adams St. 428
 Sanitary Constr. Co., 1476 W. Austin Ave. 558
 Vitrolite Co., 120 S. La Salle St. 588
 Western Mosaic & Terrazzo Co., 4214
 Ogden Ave. 26

WALL BEDS.

Pick-Barth, Albert, Cos., 1200 W. 35th St. 6

WALL BOARD.

U. S. Gypsum Co., 300 W. Adams St. 38

WALL COPING.

Am. Terra Cotta & Ceramic Co., 228 N. La Salle St. 34
 Ill. Fire Proof Constr. Co., 228 N. La Salle 426

Midland Terra Cotta Co., 105 W. Monroe 28
 Nat. Fire Proofing Co., 228 N. La Salle 424
 Northwestern Terra Cotta Co., 2525 Cly-
 bourn Ave. 10

WARDROBES.

Dodge, H. B., & Co., 332 S. Michigan Ave. 48

WASHING MACHINES

Commonwealth Edison Co., 72 W. Adams
 St. 354-374
 Peoples Gas, Light & Coke Co., 122 S.
 Michigan Ave. 380-500
 Pick-Barth, Albert, Cos., 1200 W. 35th St. 6

WATER HEATERS—AUTOMATIC.

Crane Co., 836 S. Michigan Ave. 482-544
 Kewanee Boiler Co., 1858 S. Western Ave. 476
 Westinghouse Electric Mfg. Co., 20 N.
 Wacker Drive 320

WATERPROOFING.

Central Ironite Waterproofing Co., 111 W.
 Washington 52
 Fulton Asphalt Co., 228 N. La Salle St. 56
 Johns-Manville Sales Corp., 230 N. Mich-
 igan Ave. 8
 Moore, Edw., Roofing Co., 2729 W. Mad-
 ison St. 44

WEATHER STRIPS—METAL.

Chamberlin Metal Weather Strip Co., 704
 S. Dearborn St. 50

WINDOW ADJUSTERS.

Detroit Steel Prod. Co., 11 W. Wash. 18
 Lupton, David, Sons Co., 333 N. Michigan 20
 Norton Door Closer Co., 2900 N. Western 58

WINDOW GUARDS.

Cyclone Fence Co., Waukegan, Ill. 46

WINDOW LOCKS.

Grand Specialties Co., 3101 W. Grand 90

WINDOW AND DOOR SCREENS

Chamberlin Metal Weather Strip Co., 704
 S. Dearborn St. 50

WINDOW WASHERS—ANCHORS AND SAFETY BELTS.

Imperial Brass Mfg. Co., 1232 W. Har-
 rison St. 546

WINDOWS—STEEL.

(See Steel Windows)

WIRE—ELECTRIC.

Mark, Clayton, & Co., 111 W. Washington 330
 Indiana Rubber & Insulated Wire Co., 620
 W. Jackson Blvd. 326

WIRE—RUBBER COVERED.

Indiana Rubber & Insulated Wire Co., 620
 W. Jackson Blvd. 326
 Mark, Clayton, & Co., 111 W. Washington 330

WIRE WORK.

Architectural Bronze & Aluminum Co.,
 5315 Ravenswood Ave. 420
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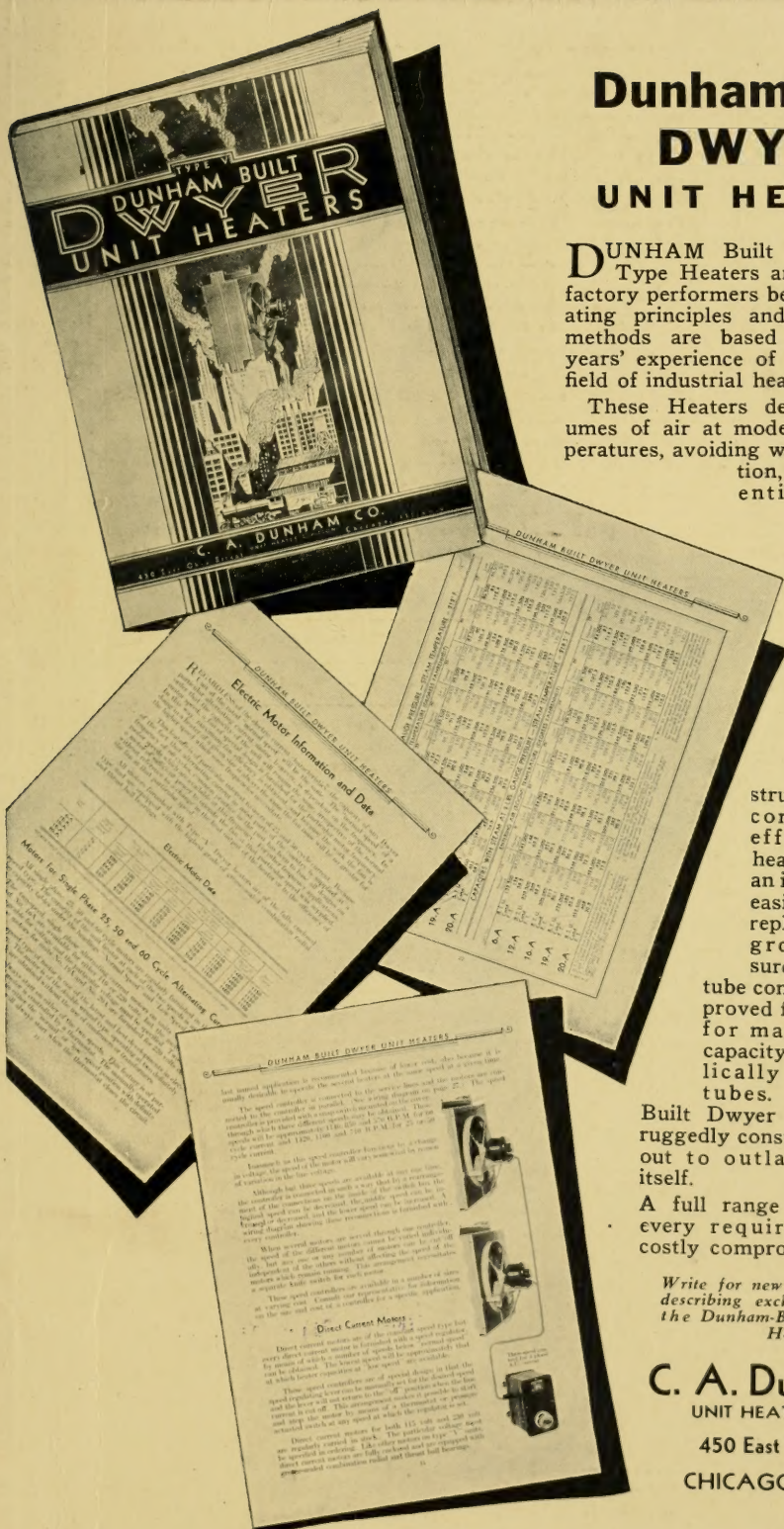
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